SIEMENS

SIREMOBIL ISO-C

SP

Function Description

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Versions

The SIREMOBIL ISO-C is supplied with a 9" X-ray image intensifier. You can select from among five different image memories: MEMOSKOP C, MEMOSKOP C&MOD, MEMOSKOP C-E, MEMOSKOP C-SUB and the MEMOSKOP C-SUB&MOD. The monitor trolley can be equipped with two 100Hz or 120Hz monitors. Standard 100Hz / 120Hz monitors are available as well as the SIMOMED 90 N monitor.

The following optional accessories are available:

- Laser targeting device / I.I. laser targeting device
- Area dose product measurement device
- Multiformat camera / Laser camera connection
- Video printer
- Video recorder
- DICOM- Bridge
- Multi-room connection

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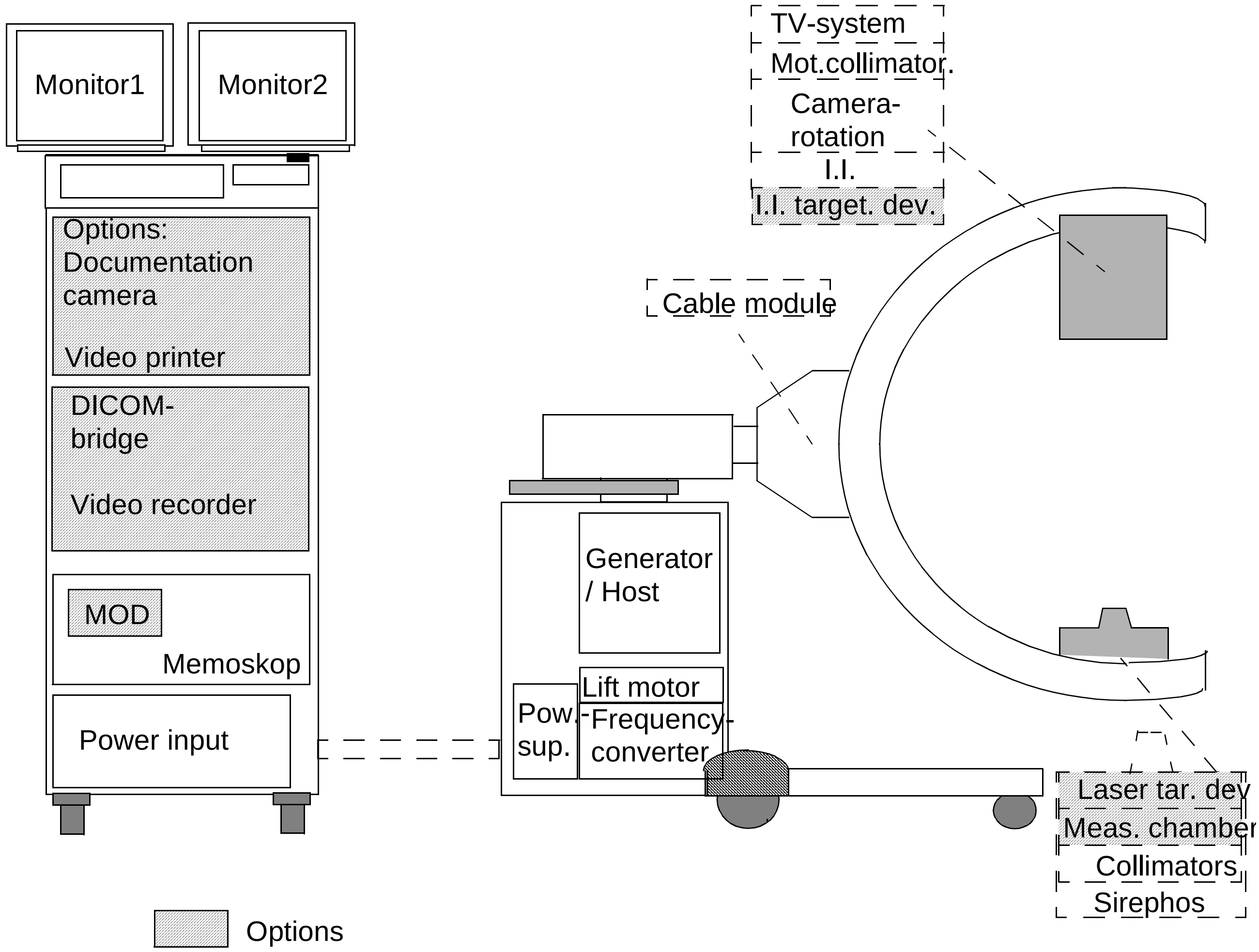


System data

Connection data

The SIREMOBIL ISO-C can be connected to the following line voltages:

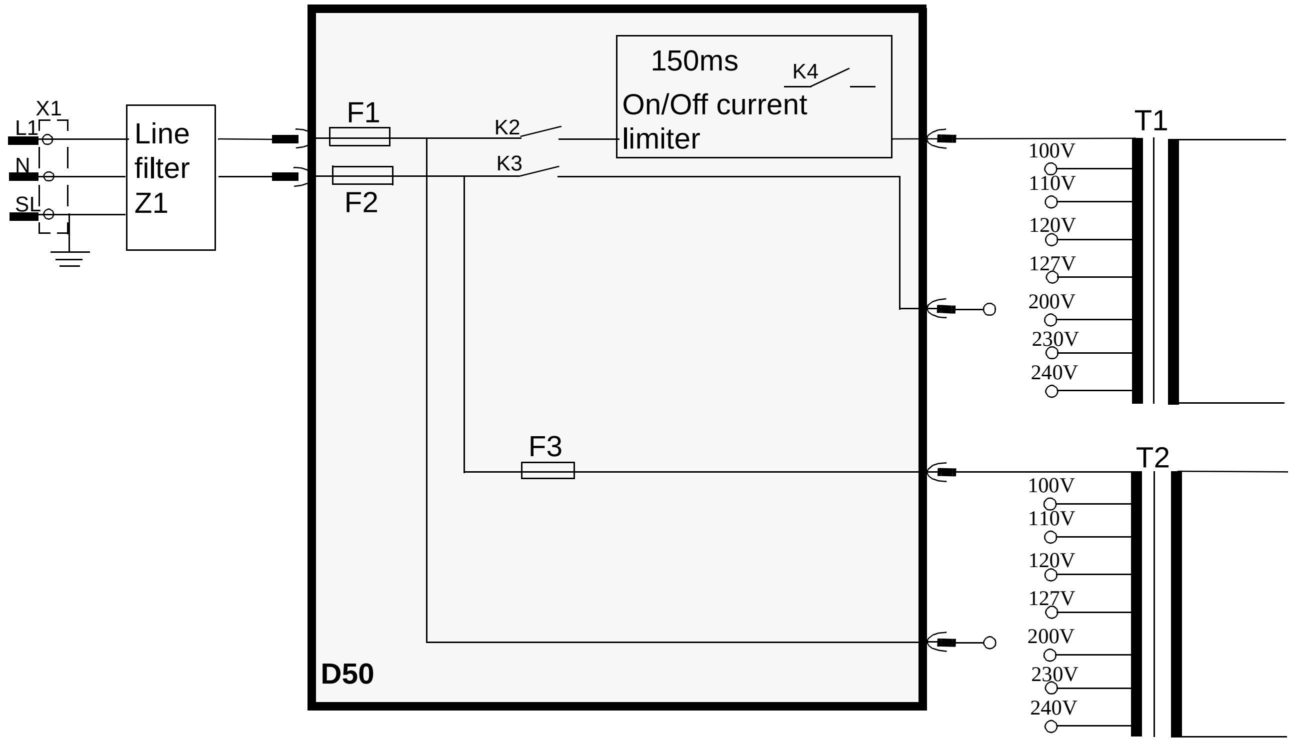
- **100V,110V, 120V, 127V**, with an internal line impedance of **$\leq$ 0.3ohms** and
- **200V,230V, 240V,** with an internal line impedance of **$\leq$ 0.8 ohms**.

Power consumption is **1.65 KVA;** may however, reach **2.7 KVA** for brief periods.

Service philosophy

Service for the SIREMOBIL ISO-C is done at the board or component level. When boards or components are replaced, there are few or no adjustments. The image memory must be replaced as a complete unit, if defective.

Line power input circuit



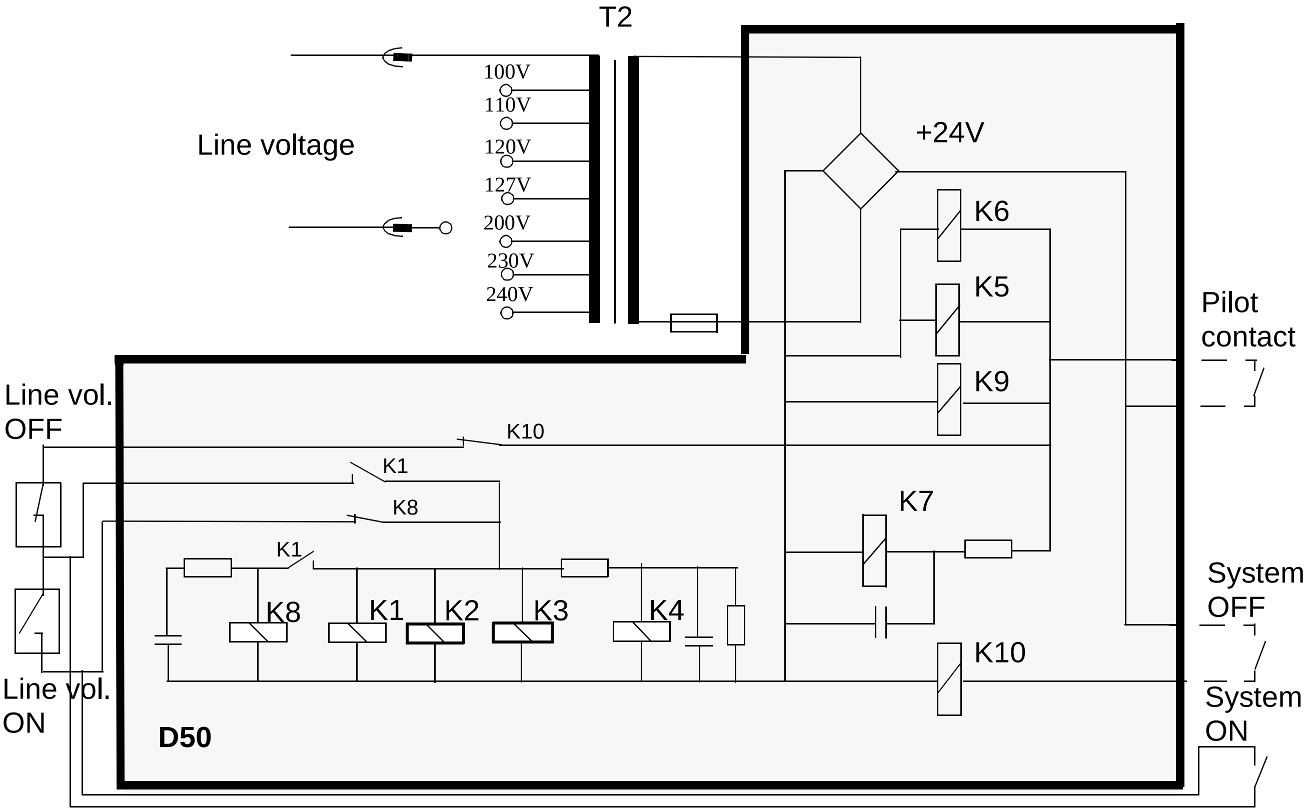
After connecting the system to line voltage, auxiliary transformer T2 is immediately supplied with voltage and delivers 19V~ to the switch-on circuit.

Power transformer T1 is supplied with line voltage only after the SIREMOBIL Compact is switched on and relays K2 and K3 are energized. The contact current is limited immediately after switching the line voltage ON for a period of 150ms to prevent the line fuse from responding due to peak input current.

Line filter Z1 in the switch-on circuit suppresses any interference superimposed from the power line supply or from the SIREMOBIL ISO-C.

The main system filters are located behind the line filter. The SIREMOBIL ISO-C is supplied with 20A slow-blow fuses for line voltages up to 127 V~ and with 15A slow-blow fuses for line voltages of 230V~ and up.

Switch-on circuit



Relay function K1, K2, K3 / Switch-on relays

In order for the system to switch on, the power ON switch on the monitor trolley or on the system console must be activated. Relays K1,K2 and K3 make contact immediately and relay K4 is delayed. The K1 relay contact bypasses the power ON switch so that the system remains switched on when the switch is no longer pressed (latching). Relay contacts K2 and K3 forward the line voltage to power transformer T1.

Relay function K4 / Current limiting device

The K4 relay switches on with a 150 ms delay after power ON and bypasses the NTC resistor of the current limiter.

Relay function K8 / Switch-on delay

If the power OFF switch is activated, latching is interrupted and relays K1, K2 and K3 immediately deenergize. Subsequently, the K8 contact remains open corresponding to the time constant of the parallel RC element, so that the system can be switched back on only after a short delay (approx. 5 seconds).

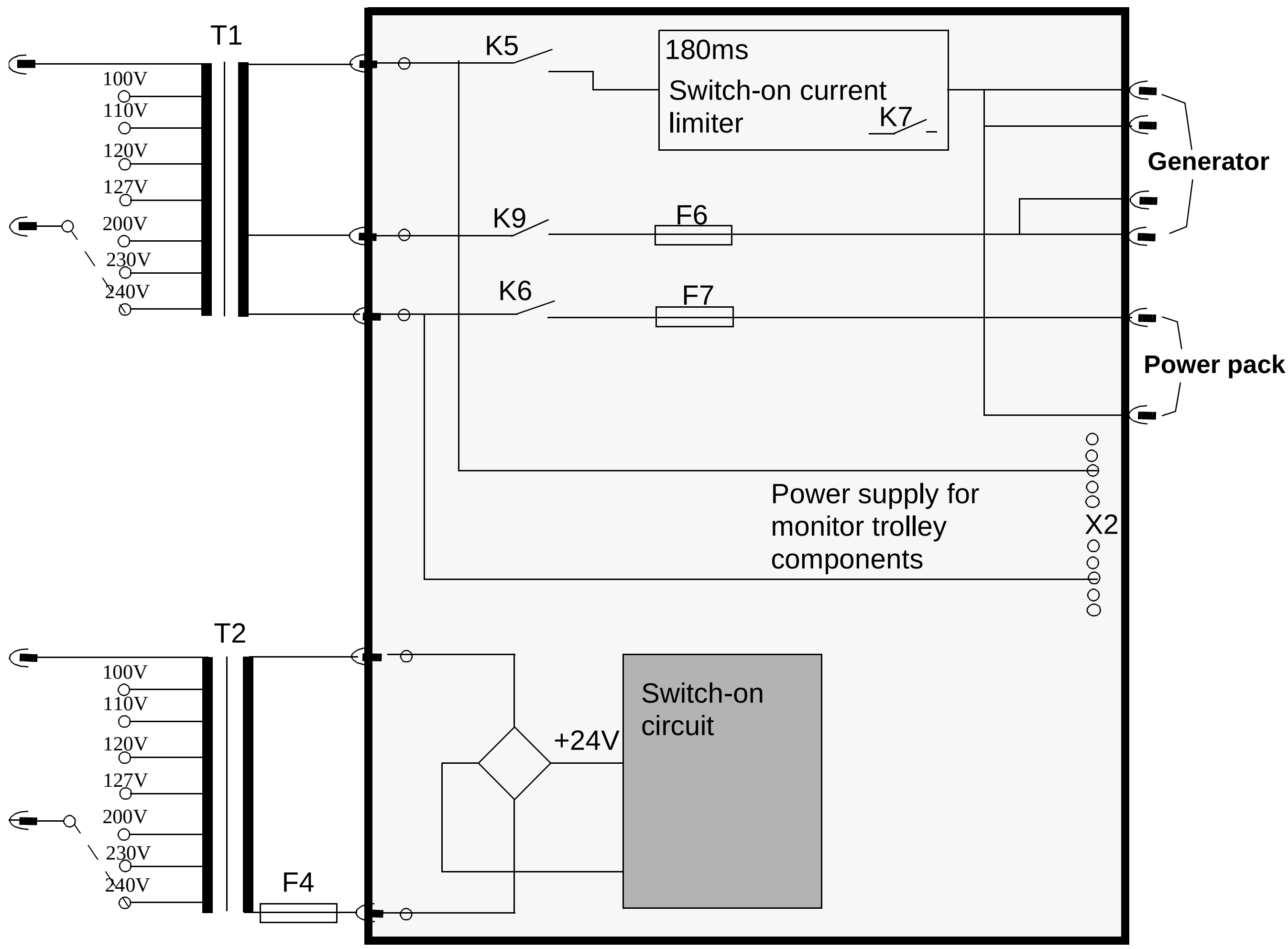
Relay function K10 / System OFF

If the system OFF switch is activated at the SIREMOBIL system console, the K10 contact opens and interrupts the supply current for switch-on relays K1, K2 and K3.

Relay function K5, K6, K7, K9 / Pilot

Relays K5, K6, K7 and K9 switch only when the monitor cable on the SIREMOBIL stand is connected.

Component power supply

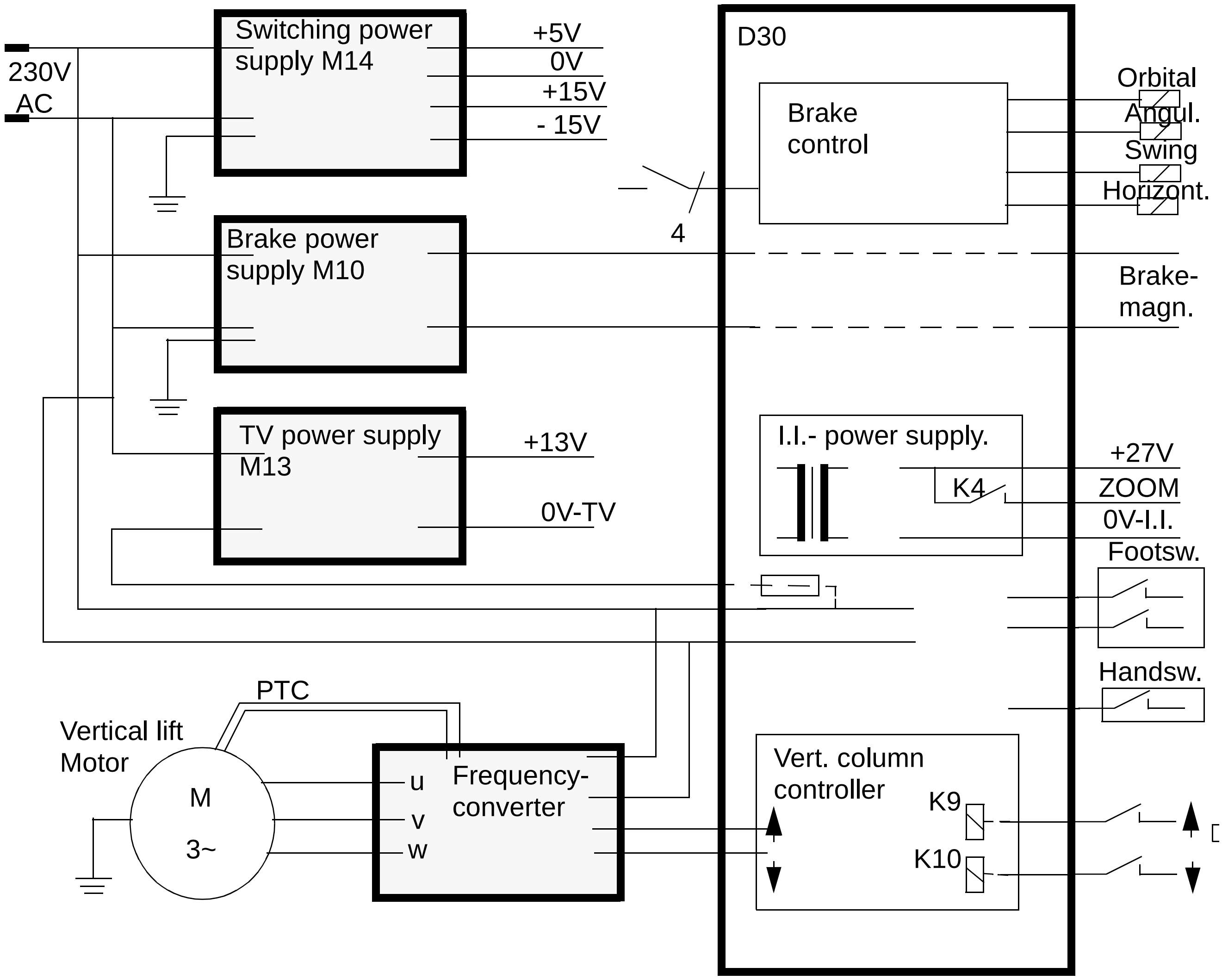


When the monitor cable is connected, relay contacts K5 and K9 forward a supply voltage of 190V~ to the generator.

An additional current limiter ensures that the current for the generator remains at an acceptable level when the monitor cable is connected. After 180ms, the K7 relay contact bypasses the NTC resistor in the current limiter.

The components in the monitor trolley, e.g. monitors, multiformat camera, video printer, etc., are supplied with power via the X2 connections.

Power supplies in the cabinet



Power supplies **M10**, **M13** and **M14** are located in the SIREMOBIL electronics cabinet.

Power supply **M14** supplies the system voltages:

+5V for: D1; D2; D30; control unit, camera rotation, and laser targeting device.

+15V

for: D1; D2; D30; iris collimator and diaphragm plates.

-15V

Power supply **M13** supplies a non-referenced voltage for the TV system of :

+13V /1A

M10 supplies voltage for the electro-magnetic brakes.

A 3-phase motor is used to raise / lower the C-arm. A **Frequency converter** supplies the operating voltage.

The **Brake controller** on board D30 controls the individual brake magnets for orbital movement, angulation, swivel movement, horizontal lift and vertical lift.

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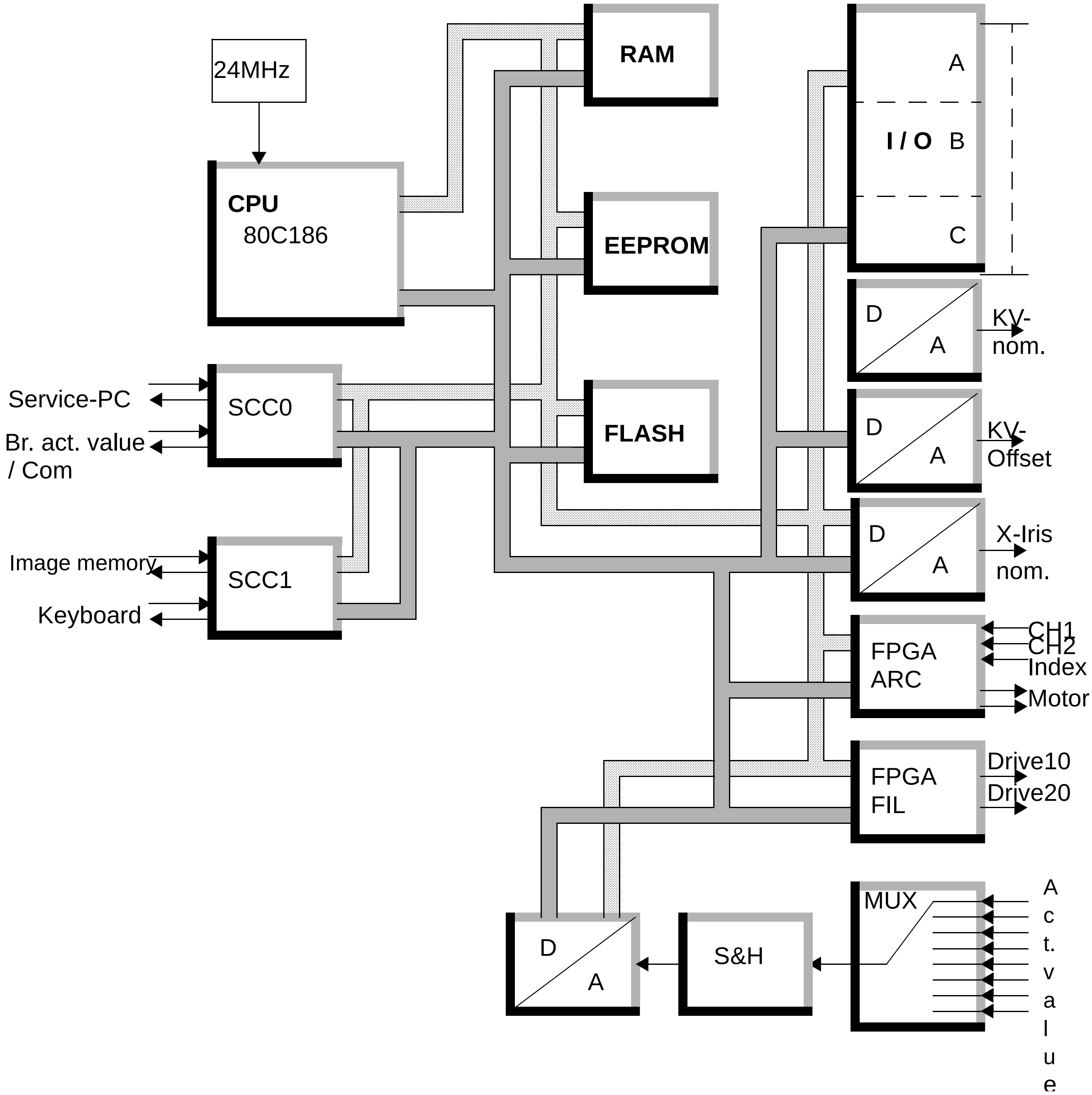
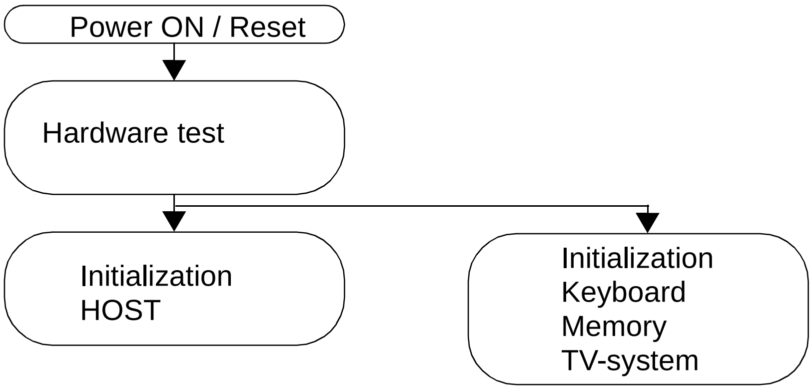
Host computer

The host computer and various generator modules are located on board D1. The host is a computer system based on the 80C186 µC with a system clock of 24MHz. The CPU storage consists of the working memory (RAM), the memory for system parameters (EEPROM) and a memory for the host software (FLASH). Internal communication takes place via I/O components, communication with peripheral system components or with the service PC is via four RS232 interfaces (SCC0 / SCC1), some of which are designed as 20mA current loops. Analog nominal values are output via D/A converters. The analog actual values are selected by an 8:1 multiplexer and subsequently converted to digital values by an A/D converter.



Initialization



After the system has been switched on and the supply voltages are stable, the processor system initially performs a self-test. If an error occurs during the self-test, an error message is displayed on the 7-segment display on board D1. If the self-test is successfully completed, the system is initialized by the host computer. In this process, standard values for KV and mA corresponding to the average values of the selected characteristic curves will be calculated; however, the displays will remain on 0 KV, 0 mA and 0 minutes, etc. The system initialization depends on the host download software resident in memory. After board D1 runs a self-test, the peripheral system components are initialized. The following sequences will be activated depending on the results of the self-test.

Service switch and displays on board D1

Service switches S2 and S3 and reset switch S1 are located on board D1. S2 is a safety switch that can be used to block radiation release. If S2 is in position 1, radiation release is enabled. Service switch S3 has four functions:

S3.1-Reserve

S3.2-Download image memory (center segment of V20 flashes)

S3.3-Download Boot software (Status indicator V20 sweeps vertically)

S3-4-Radiation blocked

The V20 status indicator displays the test results of the host system accordingly:

0--Processor-error D1 1--Checksum-error D1 2--RAM-error D1

4--Watchdog- error 8--Telegram-error, serial Port Service PC

9--Telegram overrun error, Serial Port Service-PC

b--Telegram-break error, Serial Port Service-PC

C--Telegram Checksum error, Serial Port Service-PC

E--A/D-converter error D1 F--Telegram framing error, serial port Service-PC L--CPU timer error

S--serial port to Service-PC defective

P--Telegram parity error, serial port Service-PC

d--Init EEProm

The status is briefly displayed during the course of a test routine. If the display stops permanently on an error status after a test, an error has occurred.

rotating left -- Status Boot software

rotating right --Status Host software

(Refer also to ’Moreinfo Help’ in the service software)

In addition, various LED’s for indicating status or errors are located on board D1.

V30 (red) displays a Timeout Signal if, during a defined period of time, there has been no significant activity of the CPU system (Watchdog function).

V31 (red) indicates that the +/-15V power supply is defective.

V32 (red) indicates that the oil pressure switch in the SIREPHOS has responded.

V33 (red) lights when the maximum high tension has been exceeded.

V34 (red) lights, when the maximum frequency inverter current has been exceeded.

V35 (red) indicates, that maximum filament current has been reached.

V36 (red) indicates a short circuit in the filament circuit inverter.

V52 (green) lights when the radiation iris is activated.

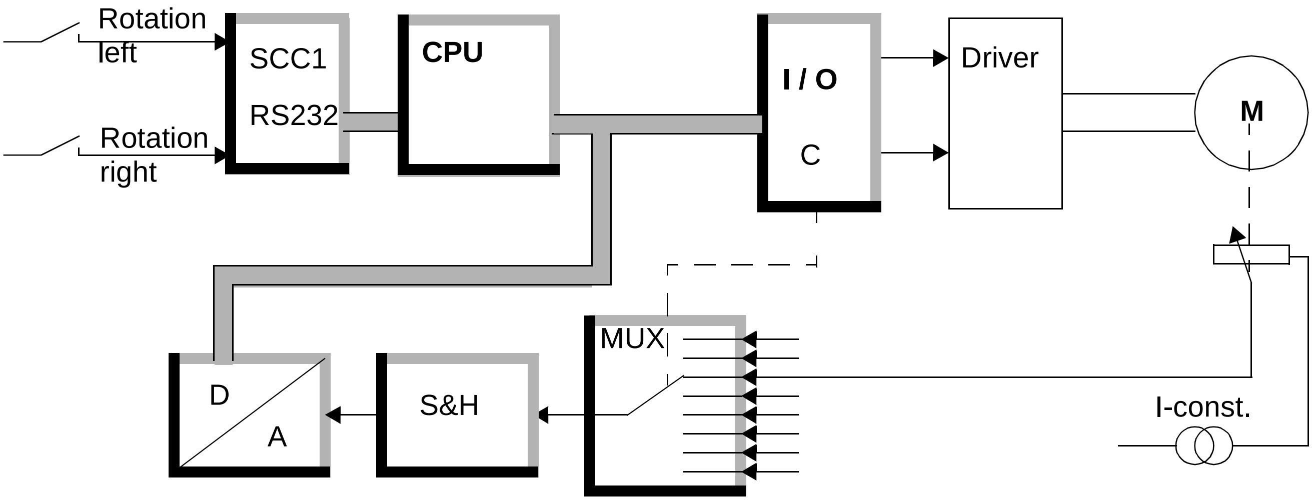
V53 (green) is the signal for ’radiation required’.

V54 (green) is the feedback signal for ’Radiation required’.

V85 (green) lights, if radiation is released with switch S2 (SS).

V91 (green) indicates that the +5V power supply is present.

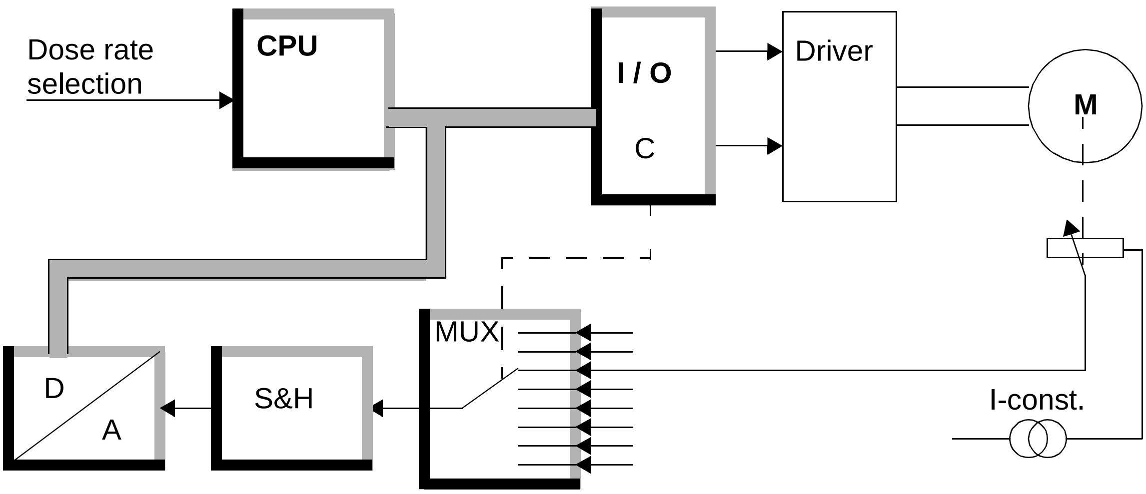
Camera rotation



The rotational direction for the CCD camera is entered with the left or right rotation keys. A driver controls the motor and rotates the CCD camera with the optics. A mechanically coupled potentiometer supplies the actual value of the camera position. This actual value is forwarded to the CPU controller via a multiplexer, stored intermediately in the S&H stage and is then converted to a digital value. The CPU compares the actual value with the nominal value resulting from the actuation of the rotation keys or from stored nominal values, according to the operating mode. In addition, the actual value signal generates the camera position indicator and an orientation marker which is superimposed on the monitor image when radiation is ON.

The CCD camera can be set within a range of +220° to -220°, +/-2°.

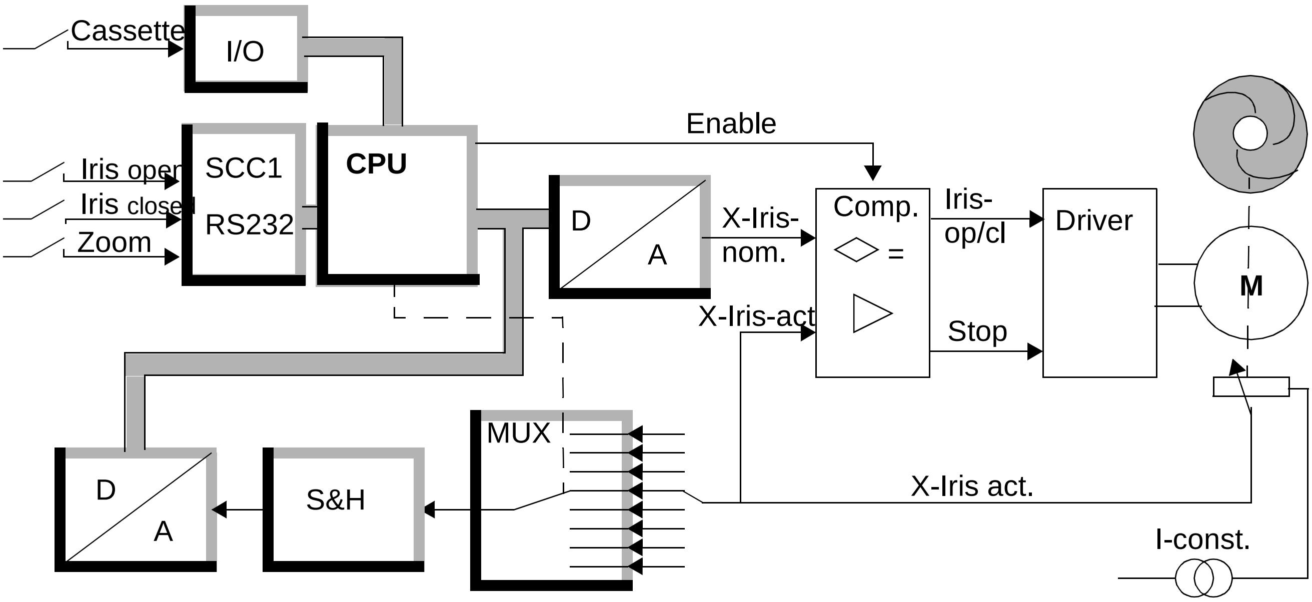
TV-iris collimator control



Since the actual value for dose rate control for SIREMOBIL ISO-C is acquired from the image signal, the dose rate can be changed via the TV iris collimator. A motorized, regulated TV iris collimator has been installed in order to facilitate selection of various dose rate values. Three different dose rate values can be programmed via the organ programs. In this way, different iris collimator apertures can be set, whereby the actual value may be higher or lower. By comparing the values with the constant nominal value, other dose rate values can be produced.

Collimator control

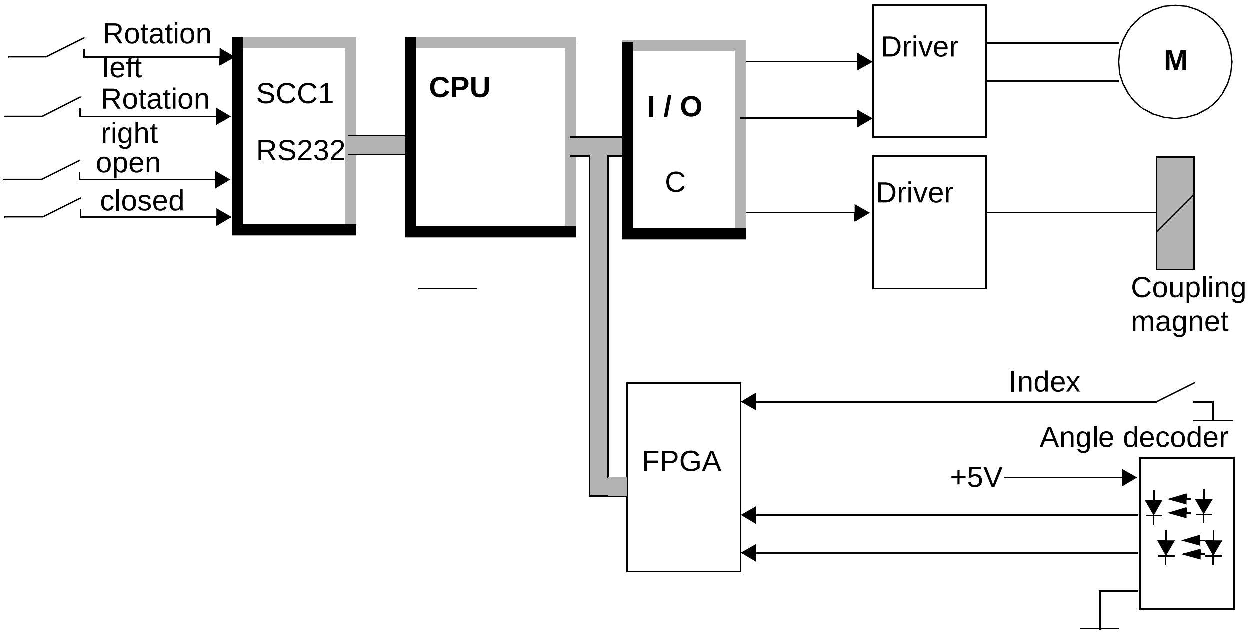
X-Iris control



The X-iris has a motorized control system which responds to the selection of control keys Iris open / Iris closed or the I.I. format / cassette format. The driver motor is mechanically coupled with the iris collimator and an actual value potentiometer to acquire the position of the iris collimator. The actual value is forwarded to the comparator. In addition, it is then forwarded via a multiplexer to the CPU, entered in intermediate storage in the S&H stage and converted into a digital value by an A/D converter. The CPU supplies a digital nominal value which is forwarded to the comparator after being converted by the D/A converter and there, it is compared with the actual value. If the nominal vs. actual value exceeds a certain value, the collimator motor is activated. As long as the nominal value = actual value, the collimator motor armature is not supplied with current and is not activated. The enable signal from the CPU enables motor activation.

The X-Iris can be opened to maximum aperture for the selected I.I. format (survey or zoom) during Fluoroscopy or Digital Radiography. It is normally opened to maximum aperture in exposure mode. Only when both X-iris keys (open / close) are pressed simultaneously in FL / DR mode will the X-iris collimator move into position for exposure mode. The LED in the iris collimator OPEN key lights when the iris collimator is opened to maximum aperture.

Slot diaphragm control



The slot diaphragm can be opened and closed with the corresponding keys. The diaphragm plates can be moved symmetrically into the center. In exposure mode, the diaphragm plates are moved into a park position outside the exposure format. When current is switched ON, the diaphragm plates are opened.

When the diaphragm plates are opened and closed, the motor and coupling magnet are simultaneously activated. The coupling magnet reverses the mechanical control so that the diaphragm opens or closes, as required.

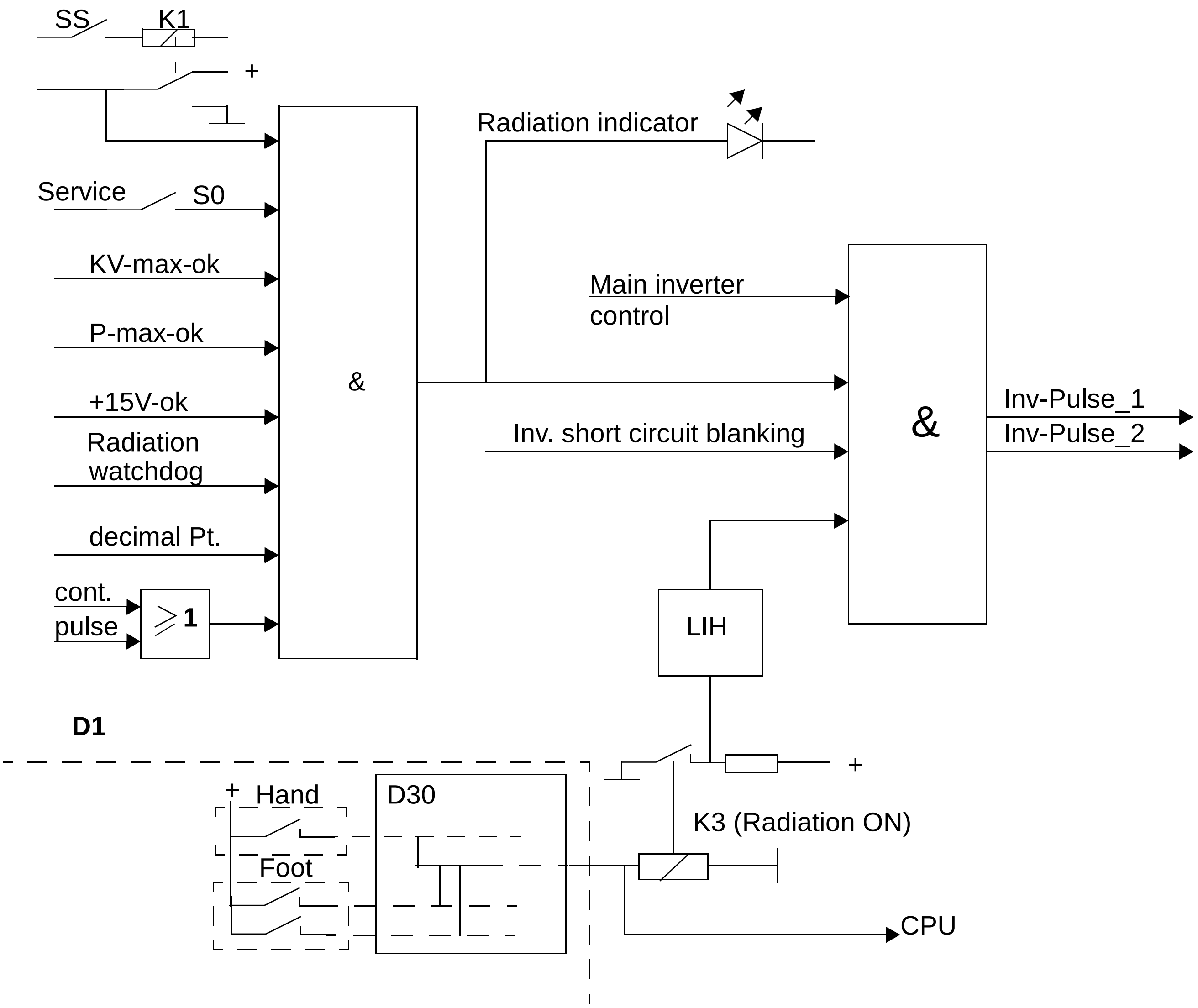
So that the diaphragm can be adjusted without radiation as well, the actual position is acquired via an angle decoder. To accomplish this, the diaphragm moves to an index position defined by a microswitch when the system power is switched ON and from this position the programmed diaphragm setting is adjusted. Each time the index position is reached, the position value is reset to ensure a high degree of accuracy.

Collimator for cassette format

A permanently installed collimator is used for the 24*30 format in exposure mode. The I.I. format is not compromised by the exposure collimator. The position of the exposure collimator is also fixed, because the position of the cassette holder is defined by the patient longitudinal axis. In general, the X-iris collimator and the diaphragm plates are opened to maximum aperture in exposure mode. If, however, both keys for the respective collimator function are activated simultaneously prior to inserting a cassette, this collimator will retain its setting.

Radiation release

Block circuit diagram

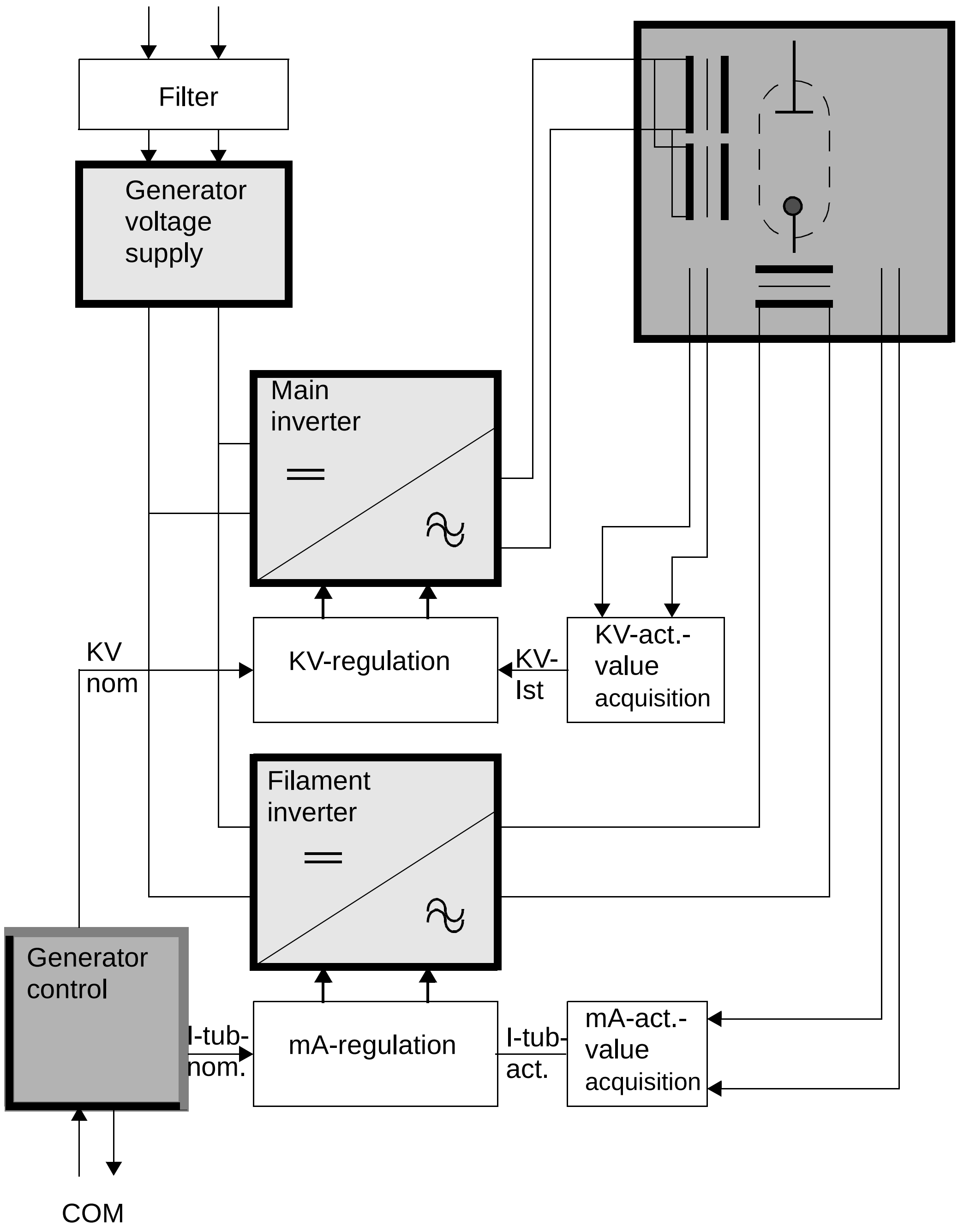


Various conditions must be satisfied before the control signals are released to the inverter and/or radiation is released. Signals such as KV-max, Sirephos overload, supply voltages, radiation watchdog and inverter short circuit blanking are polled. For service purposes, radiation release can be blocked with service switch S2 via relay K1.

Overview

The generator is located on boards D1 and D2 in the basic system. The SIREMOBIL controller is located on board D1 (HOST) as well as the generator modules for controlling the components for high voltage generation and the filament circuit.

Generator block circuit diagram



Generator voltage supply

The generator is supplied with 190 V of AC voltage from transformer T1 when the monitor trolley cable is connected. In addition, the voltages:

+5V DC for the digital components

+/- 15V for the analog components

are supplied by the M 14 power supply.

Intermediate circuit

The 190V AC voltage from transformer T1 are forwarded via a line filter (EMC) to power module D2. The AC voltage is rectified here and charges C403 to C406 in the capacitor pack. Once this happens, a stabile, intermediate circuit voltage of 266V +/- 10% is available for the main and filament inverters.

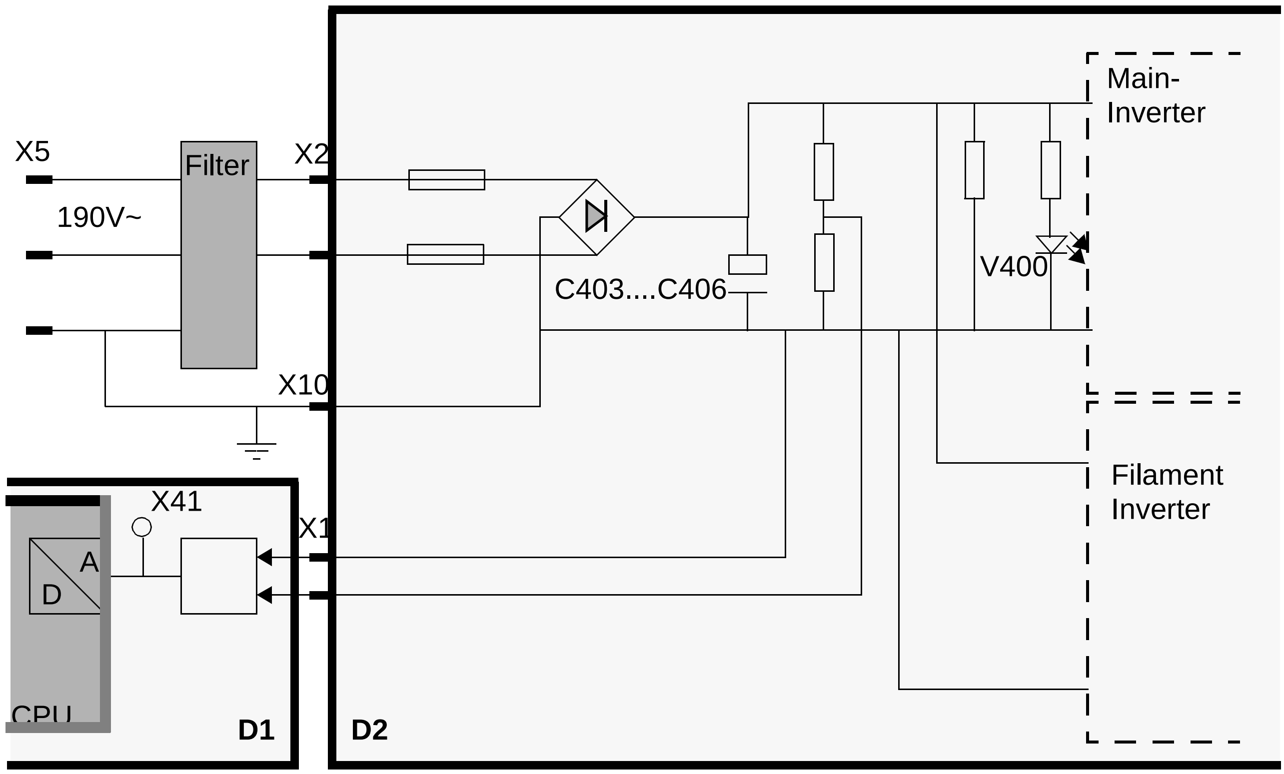
Main inverter

The main inverter converts the intermediate circuit voltage to AC voltage. During this process, the high voltage is regulated via the inverter frequency. High voltage regulation is located on board D1.

Filament inverter

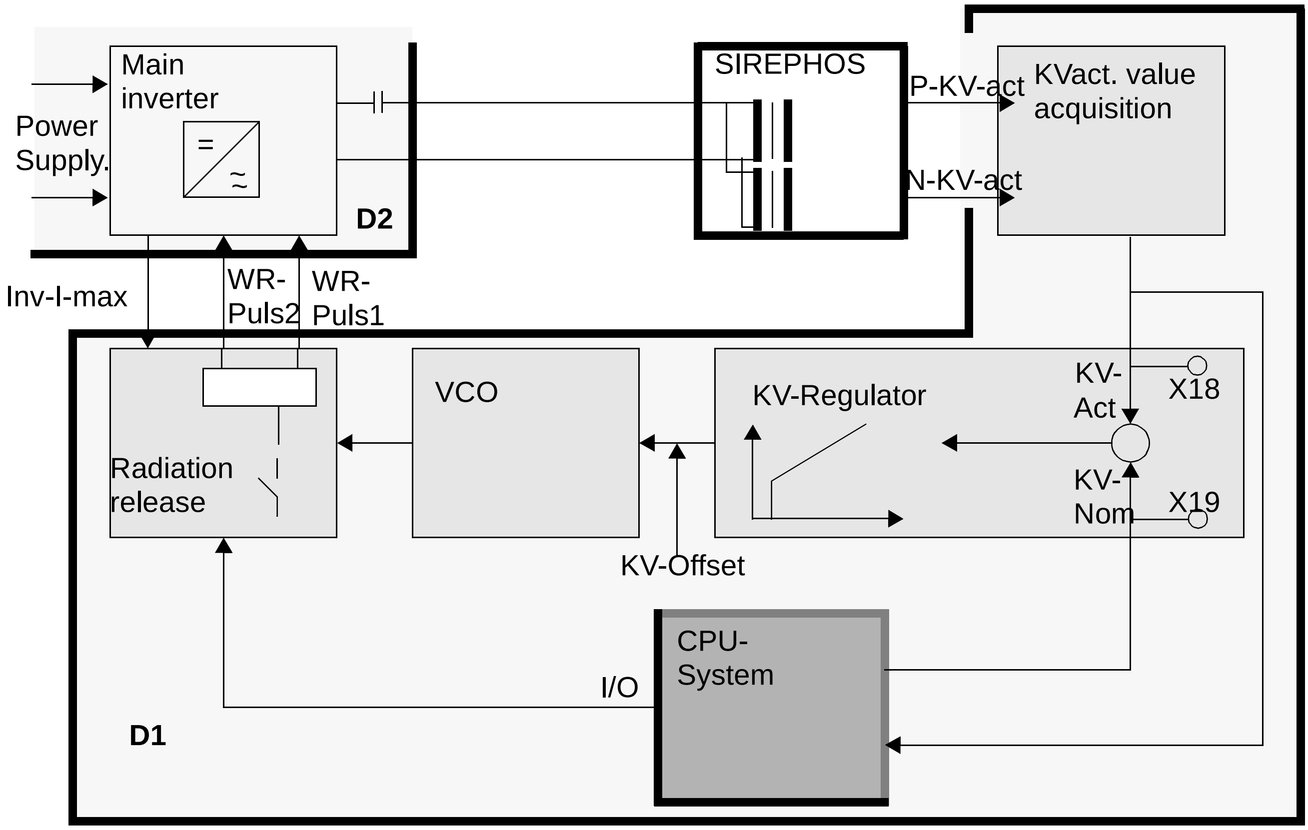
The filament inverter is also supplied with approximately +266V +/- 10% from the intermediate circuit. This voltage is converted into an AC voltage signal, regulated and forwarded via the filament transformer in the SIREPHOS to the X-ray tube filament.

Intermediate circuit



The intermediate circuit on the SIREMOBIL ISO-C supplies a fixed DC voltage to the power components. For this purpose, the 190V AC is rectified on board D2, and capacitors C403 to C406 are charged. If the SIREMOBIL ISO-C is switched off, the capacitors are discharged via a resistor. Discharge time is approximately 2 minutes. LED V400 indicates whether the intermediate output voltage is higher than 50V. The actual value is acquired via a voltage divider and converted on board D1 into a digital value. This digital actual value is compared with the nominal values stored in the Host computer for error detection. The analog actual value of the intermediate circuit voltage can be measured at test point X41 on board D1. For the measurement, 1V actual value corresponds to 50V intermediate circuit output voltage.

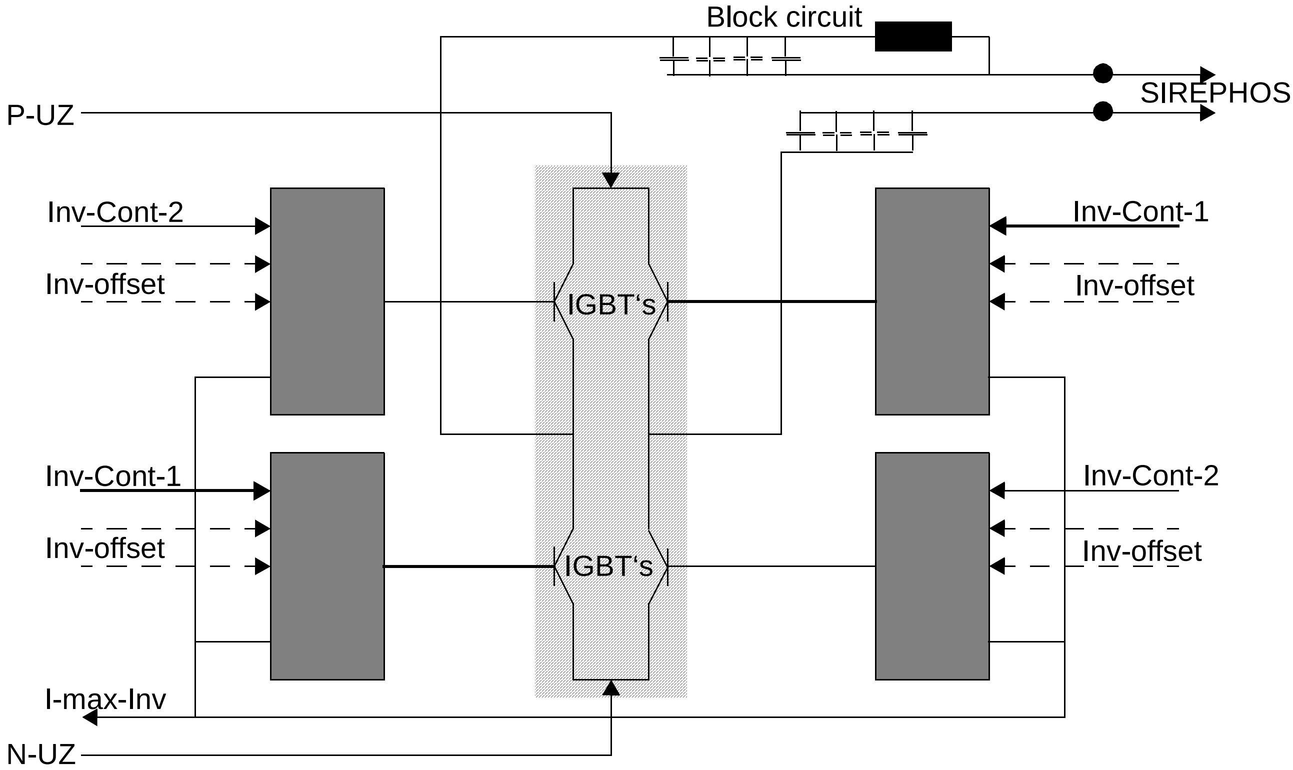
KV Regulation



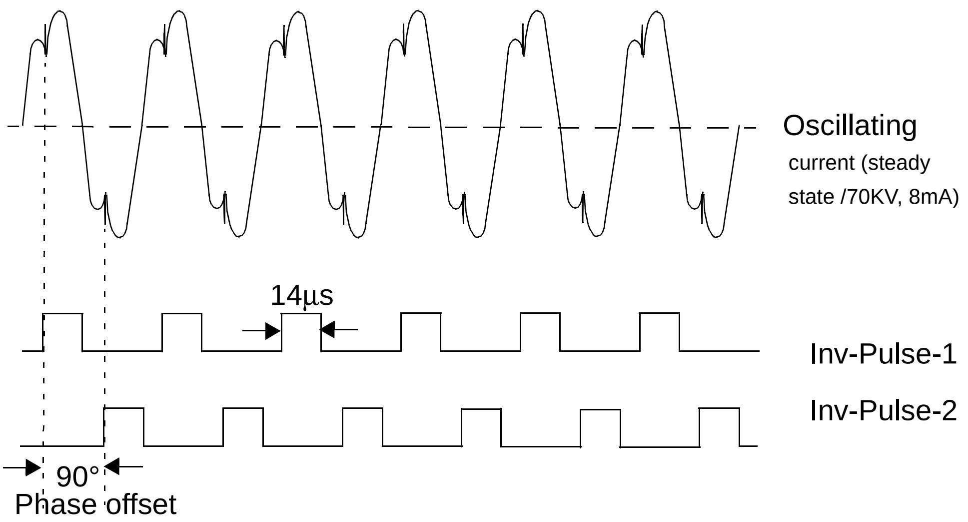
On the SIREMOBIL ISO-C, KV regulation from 40 to 110 KV takes place via the main inverter. The high voltage is controlled via the Inv-Pulse 1 and Inv-Pulse 2 signals in a frequency range of 15KHz to 35KHz. The KV-actual value which is determined by measuring the difference between P-KV-act and N-KV-act, is compared with a KV nominal value supplied by the Host computer. Both values can be measured at test points X18 (actual) and X19 (nominal), whereby a test value of 1V, 20 KV actually corresponds to 20 KV. The KV actual value is also transmitted to the Host computer via monitoring. The KV regulator has a PL-characteristic with a resettable I-section. Depending upon the difference between the KV nominal and KV actual values, the regulator supplies a control voltage for the VCO that generates a corresponding clock signal. The input voltage for the VCO ranges between 0 and 10V and controls the output frequency within a range from 30 to 70 KHz. This control signal is enables radiation ON in the subsequent module.

The KV offset is adjusted during the generator learning phase.

Main inverter

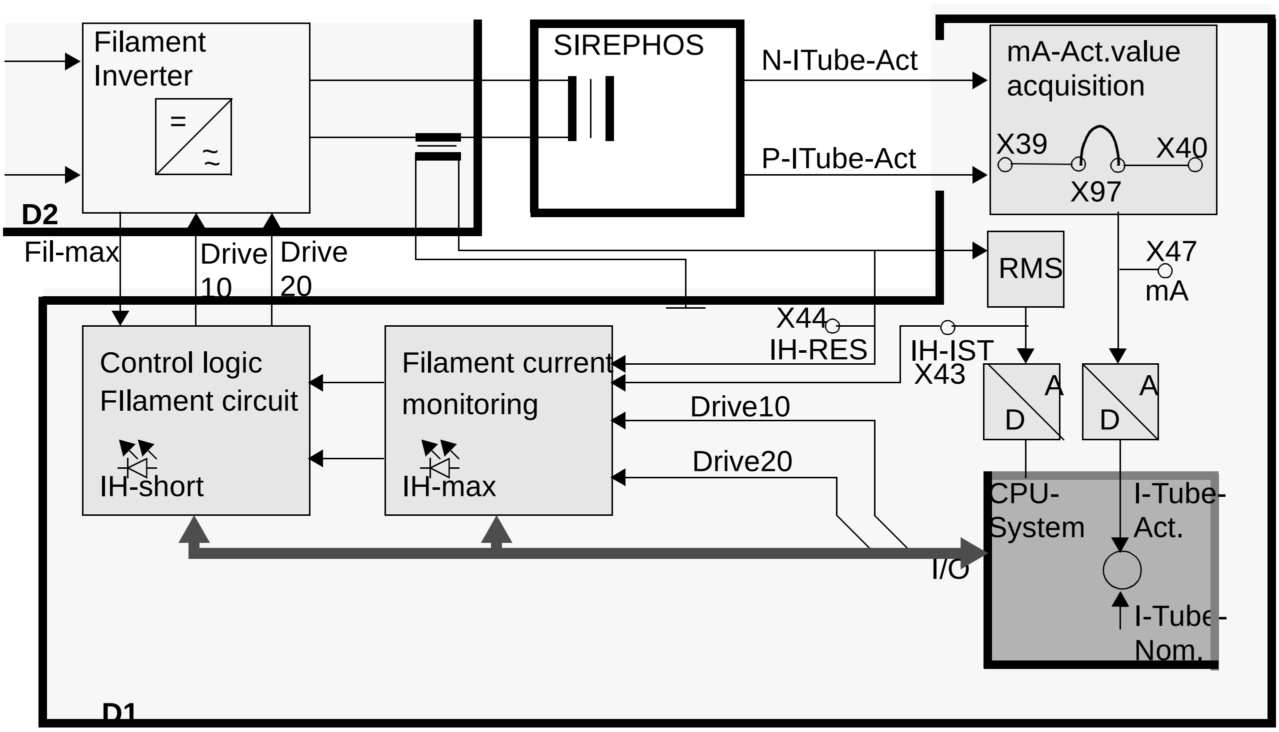


The inverter control signals, Inv-Cont-1 and Inv-Cont-2, range in frequency from 15 to 35 KHz and have a constant pulse width of 14 µsec. These pulses control the respective IGB transistors (isolated gated bipolar), diagonally opposite, whereby the polarity of the resonance circuit from the oscillating circuit capacitors, the high voltage transformer and the block circuit are reversed. The high voltage for the X-ray tube is produced by recharging the capacitors of the secondary voltage quadrupling circuits.



Relationship between regulator, oscillation and high voltage.

Filament circuit



The half bridge oscillating inverter for the filament circuit is located on power component D2. Actual value acquisition on board D1 generates the actual value for tube current regulation from the N-ITUBE-Act and P-ITUBE-NOM signals supplied by the SIREPHOS (in Stand-by mode the Siremobil switches to filament circuit regulation). The actual value is converted to a digital value and compared with a nominal value via the CPU. From these values, an ASIC circuit produces the corresponding Drive10 and Drive 20 control signals. The filament current is regulated by the frequency of these control signals which ranges from 20 to 43KHz. If the maximum acceptable filament current is exceeded, the Drive 10 and Drive 20 control signals are blocked by the filament circuit monitoring.

VIDEOMED-DC TV System

Overview

The SIREMOBIL ISO-C TV system is called VIDEOMED-DC. All modules, with the exception of the power supply, are located on a board installed in the I.I. housing. If defective, the entire TV board must be replaced. Since the VID-DC is a self-calibrating system, no adjustments to the camera electronics are required.

The VID-DC

- is a standard resolution CCD TV system corresponding to the CCIR (625 lines / 50Hz) or EIA standards (525 lines / 60Hz).
- supplies a standard output signal of 1 Vpp to a 75 ohm termination.
  The vertical synchronization corresponds to 50Hz or 60Hz.
- generates an actual value for the dose rate control and the automatic gain control that is derived from the B-signal.
- is a self-calibrating and self-testing TV system.
- is CPU controlled.

Optics

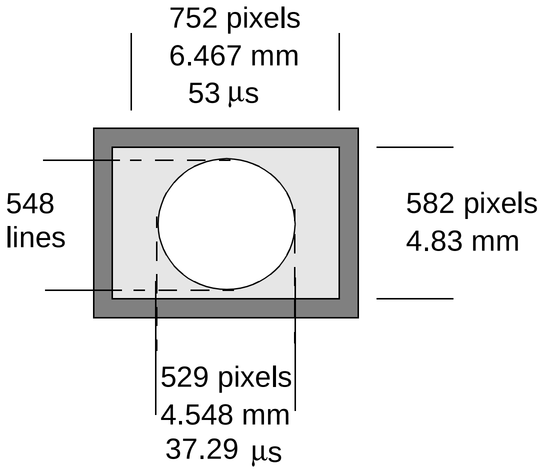
The VID-DC is adapted to the I.I. by means of optics with a manually adjustable iris collimator.

Depending on the type of I.I. installed (17cm or 23cm), there are two different optics for the VID-DC. Optical sharpness can be set by means of an adjustment wheel. The optics are integrated in a rotating mechanical frame so that the entire TV unit can be rotated. The angle of rotation is +/- 220°(+/-2°) and is displayed on the control panel. Positioning is controlled by the Host computer and the motor control is located on board D1.

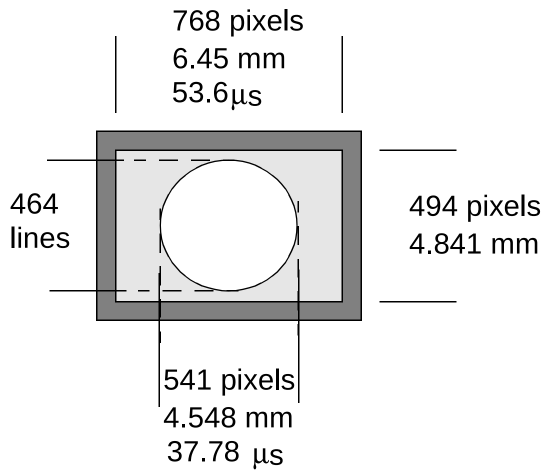
CCD Sensor

The CCD sensor converts the optical image signal that comes from the image intensifier into an electronic signal.

50Hz CCD Sensor



60Hz CCD Sensor



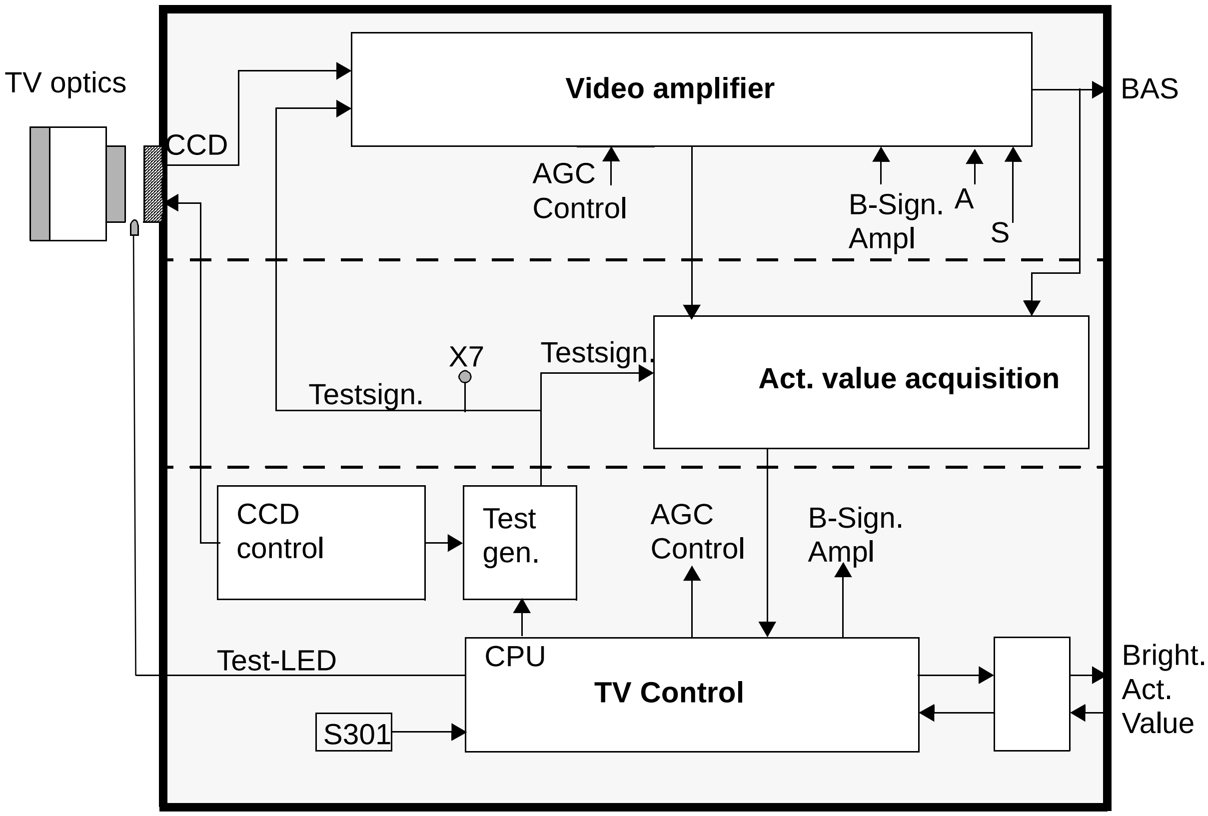
The CCD sensor used on the VID-DC works according to the Interline-Transfer principle. The image that is projected via the CCD sensor optics produces charges in the individual pixels of the CCD sensor that correspond to the intensity level of the respective pixels. These pixel charges are taken over into the corresponding readout register during the V- and H-blanking and are transmitted to the video output of the CCD sensor. The voltage across the video output resistor corresponds to the pixel charges. The total of all the individual voltage values produces the image signal.

Two different CCD sensors are used, since different matrix sizes are required for 50Hz or 60 Hz (refer to figure). For this reason, two different hardware versions have been used for the VID-DC.

In order to check the functionality of the CCD sensor, it can be illuminated using a test LED to generate an image signal.

The CCD sensor is cooled by means of a copper plate that is attached directly to the sensor. The sensor temperature should not exceed 42°C, otherwise the image quality can be adversely affected.

Block circuit diagram



The VID-DC electronics consists of three main modules:

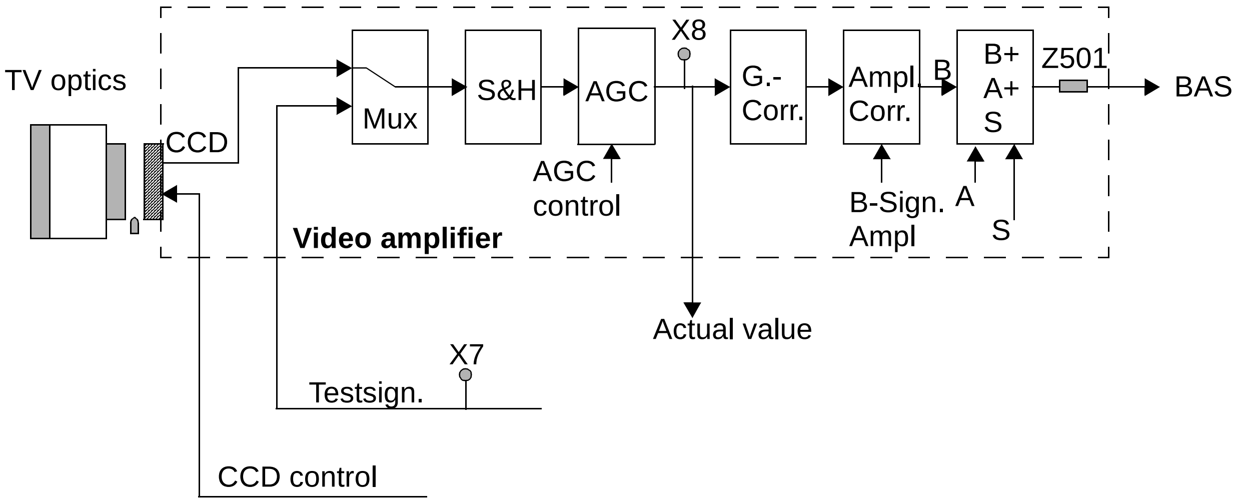
- the video amplifier
- the actual value acquisition
- the TV control.

The video amplifier generates a BAS signal of 1 Vpp to a 75 ohm termination from the analog B signal supplied by the CCD sensor.

The actual value acquisition supplies an actual value for the dose rate control and the AGC.

The TV control provides the control signals for the TV function modules and forwards the "brightness actual value" via the serial interface to the generator. The serial interface is used for communication between the Host computer and the TV system.

Video amplifier



Input multiplexer

The video signal from the CCD sensor is switched via the input multiplexer to the video amplifier. When switching the system ON, the multiplexer will enter a self-test phase during which it selects a test signal that is generated in the TV control. For service purposes, this test signal can also be programmed via the S301 service switch.

S&H stage

The Sample & Hold stage samples the video signal in the pixel clock frequency to ensure a continuous B signal.

AGC control element

The AGC regulates the video amplifier. If the SIREMOBIL brightness control cannot adjust the brightness of the B signal any further, the automatic gain control is enabled by the Host computer. The control dynamics of the AGC is 16dB. The higher the gain, the lower the signal-to-noise ratio, since the signal portion of the B signal is amplified as well. The image quality deteriorates depending on the gain factor. The control signal for the AGC is generated via the actual value acquisition and the AGC control circuit in the TV control. The CPU of the TC control compares the digitized value of the actual value acquisition with a stored nominal value and in this way, produces a digital AGC control value. This control value is subsequently converted into an analog signal and sent to the AGC servo component in the video amplifier. As long as the dose rate control does not reach its maximum value, the AGC will retain a fixed amplification. The actual value for the actual value acquisition is output at the AGC output.

Gamma correction

In order to decrease the detail contrast for the signal portions with low amplitude, the video amplifier of the VID-DC contains a gamma correction stage. This stage has a non-linear gain. The gain for the B signal portions with low amplitude is higher than for high signal amplitude values. The gamma correction compensates in a certain sense for the non-linear characteristic of the monitor picture tube. In this way, the contrast ratio and the image quality are improved. The VID-DC has a fixed gamma of 0.7.

Amplitude correction

The B signal amplitude is corrected in this component during the self-test phase that takes place after switching the system ON so that the B signal portion of the BAS signal is 650 mVpp. The test signal is used as a measurement signal.

BAS mixing stage

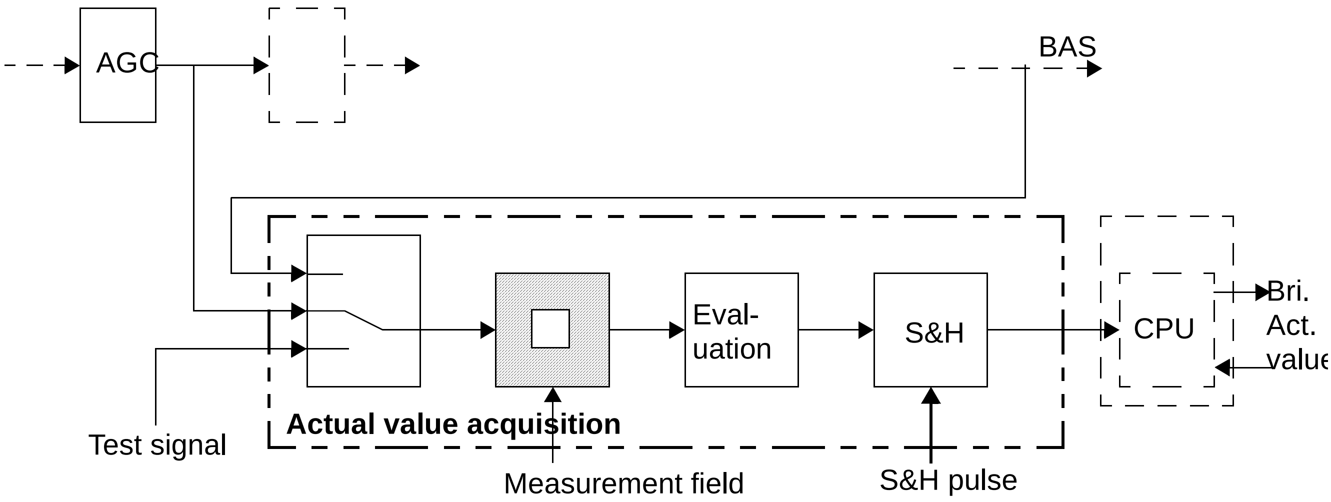
In the mixing stage, the B signal, H and V blanking signals and the synchronous signal are combined to produce the BAS signal.

The amplification values of the individual signal portions are as follows:

B signal	650mVpp
Blanking level	50mVpp
Synchronous signal	300mVpp

These signal values produce a standard BAS signal of 1Vpp to a 75 ohm termination.

Actual value acquisition



In order to generate an actual value for the automatic dose rate control and for the AGC, the B signal is coupled from the video channel behind the AGC RC component and switched to the actual value acquisition via a multiplexer. The multiplexer can select the test signal or BAS signal for other test and adjustment purposes.

Measurement field acquisition

Since the most important image sections are located in the center, the outside portion of the image is blanked during acquisition. A rectangular measurement field is used for this purpose. Only the B signal portions lying within the measurement field are forwarded for actual value generation and are able to influence the dose rate control or the AGC.

Evaluation

Since the actual value for regulation must be a DC voltage value, the mean DC value of the B signal is determined with an integrator circuit in the evaluation stage. On the SIREMOBIL Compact, there is only one evaluation mode, namely mean evaluation.

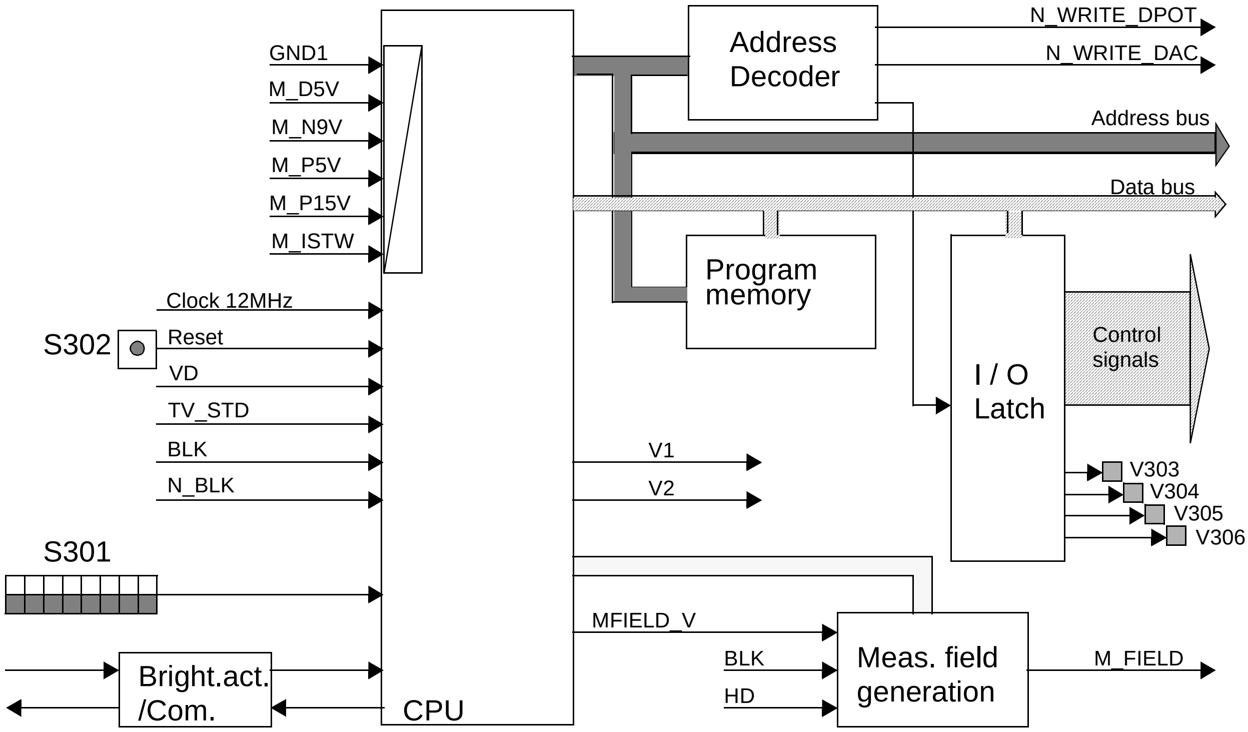
S&H stage

The DC mean value generated in this way is stored in the S&H stage. Because the sample clock corresponds to the vertical clock frequency, the actual value is updated every 20 ms (50 Hz) or every 16.66ms (60 Hz). This analog actual value is forwarded to an A/D input in the control CPU and converted to an 8bit digital value. The digital "brightness actual value" is forwarded to the AGC and via the serial interface to the dose rate control.

Notice

If the actual value acquisition or the brightness actual value malfunctions, radiation will be blocked in the control mode.

TV control



A CPU, type SAB80C535 is used to control the TV functions. The control signals are output via the I/O latch to the individual components. The TV system software is stored in the program memory.

Measurement field generation

The rectangular measurement field used on the VID-DC is stored in memory. Various different measurement fields corresponding to 50Hz or 60 Hz are addressed by the CPU and forwarded to the actual value acquisition.

Serial interface

The serial interface forwards the brightness actual value and communicates with the Host computer. The "brightness actual value" is forwarded to the generator in V clock. Communication between the Host and the TV system is enabled between the individual "actual brightness" telegrams. The serial interface configuration corresponds to a 20 mA circuit.

Analog inputs

The CPU has several analog inputs or internal A/D converters. Power supply voltages for the power-up test are converted via these inputs. In addition, the analog actual value from the actual value acquisition is converted to a digital value, the "brightness actual value".

S301 service switch

Various tests or control signals can be selected at service switch S301.

S301	.1	.2	.3	.4	.5	.6	.7	.8
Normal position	off	off	off	off	off	off	off	off
Meas. field 1								
Meas. field 2								
ACG request	x	x	on	x	x	x	x	x
AGC Stop	x	x	x	on	x	x	x	x
Radiation ON	x	x	x	x	on	x	x	x
Test signal AGC-RC component	x	x	x	x	x	on	off	x
Test signal Act value acquisition	x	x	x	x	x	x	on	x
Test LED ON	x	x	x	x	x	x	x	on

Tab. 1

X: switch position not relevant

TV initialization

The following tests and self-adjustments run during the initialization phase:

- Power supply voltage check
- Actual value acquisition adjustment
- Manual gain adjustment
- Adjustment of the B signal in the BAS signal
- Adjustment of the blanking signal in the BAS signal

When initialization is completed, the "brightness actual value" is forwarded to the generator.

Initialization of the TV system takes approximately 30s.

After initialization, the actual value acquisition is checked only once every minute. If radiation is switched on during this time, the test is interrupted.

MEMOSKOP

The SIREMOBIL ISO-C has various memory configurations.

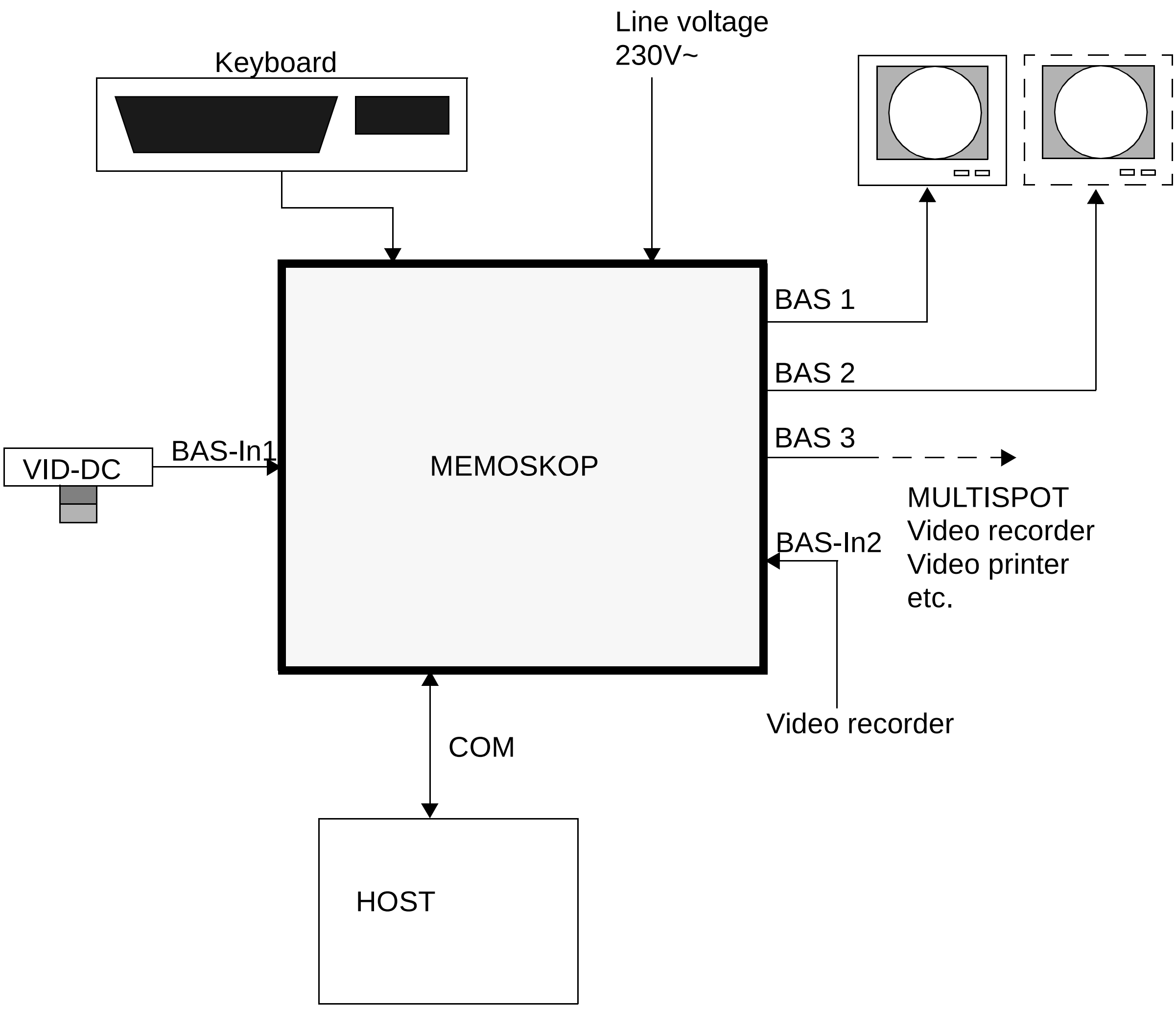
Memoskop C-E for storage of three images

Memoskop C memory with hard disk memory for storage of 700 images

MEMOSKOP C-SUB for subtraction with hard disk memory for storage of 900 images.

MEMOSKOP C and MEMOSKOP C-SUB are also available with MOD storage.

Cabling



Power supply

The MEMOSKOP is supplied with 230V AC current from isolation transformer T1 independent of the line voltage connected.

Communication

The host computer and MEMOSKOP communicate via a serial interface. This interface is physically configured similar to a 20 mA circuit. Time-critical signals, such as START from the host, and the ACQUI SITION acknowledge signal from the memory, are forwarded via their own 20 mA circuit.

BAS Input 1

The BAS signal that comes from the TV system is connected at the "VIDEO-IN" connector. The BAS signal terminates with a 75 ohm terminator resistor in the Memoskop.

BAS Output Mon1 / Mon2

The BAS outputs for monitor 1 or monitor 2 deliver a BAS signal with 1Vpp at 75 ohm and a vertical frequency that can be 50Hz, 60Hz, 100Hz or 120 Hz, depending on the configuration. Monitor 1 displays the current FL image or LIH image. Monitor 2 displays stored images.

BAS Output 3

At the BAS output 3, a BAS signal of 1Vpp at 75 ohm is available with a vertical frequency of 50 Hz or 60 Hz for video components such as multiformat camera, video printer, video recorder, etc.

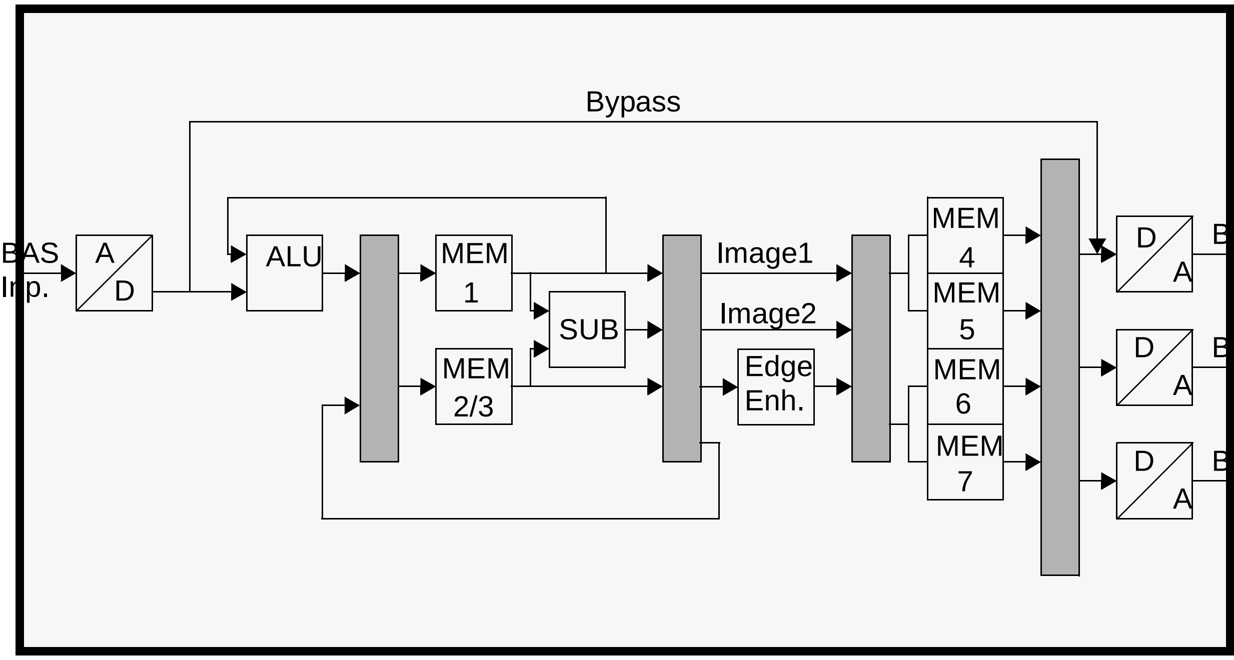
BAS Input 2 for video recorder

This BAS input is used to transmit the video signal of the video recorder.

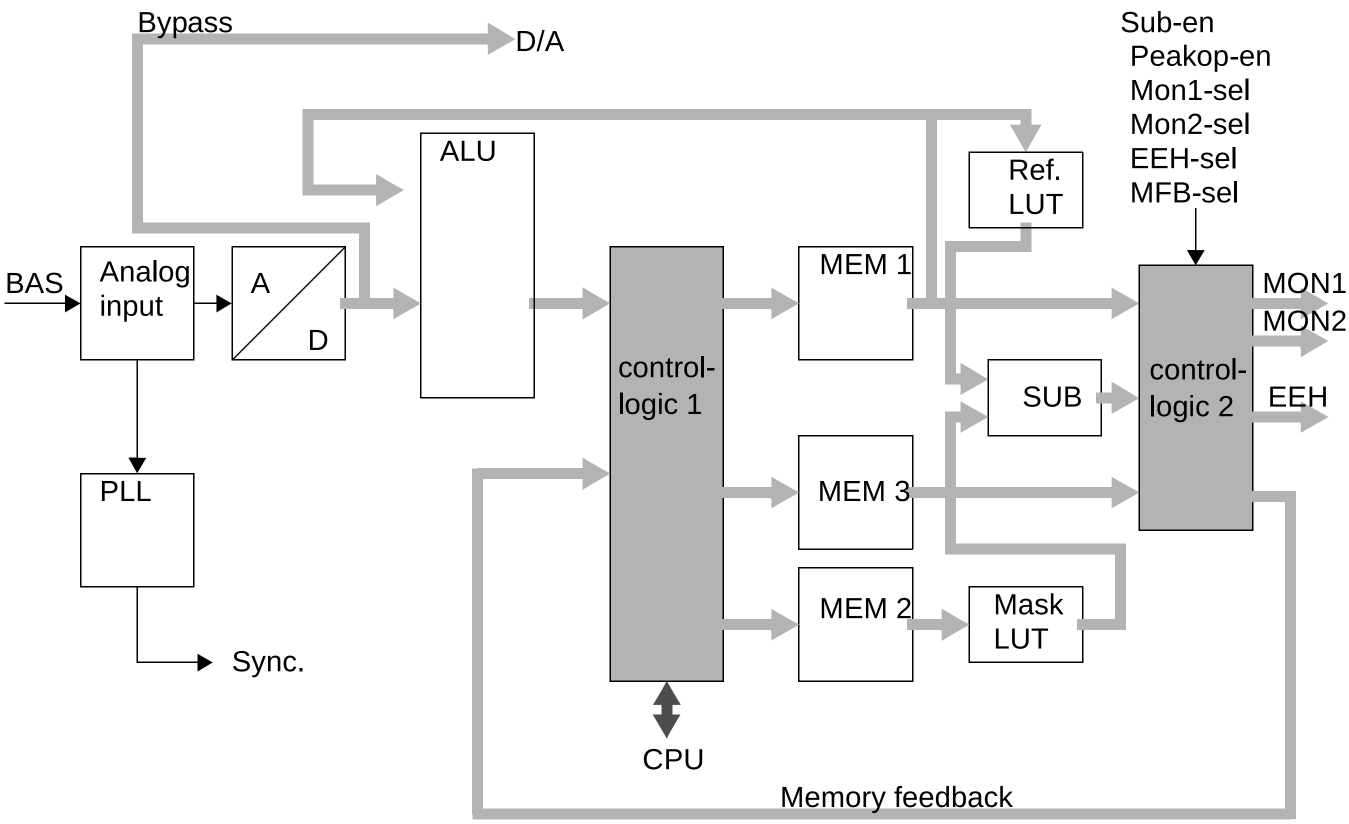
Keyboard connection

A keyboard (optional) for entering patient data can be connected via an RS232 interface to the Memoskop "KEYBOARD" jack. Various keyboards are available, depending on the country-specific character sets and the memory version.

MEMOSKOP 3000 block diagram



The A/D converter converts the analog BAS input signal into 8bit digital pixels. After this is completed, the pixel values can be computed with an ALU (arithmetic logic unit). The ALU assists in noise reduction and motion detection. The MEM1 memory is the working memory for the ALU. The image data stored here are used by the ALU for processing. The completed images are stored in the MEM 2 and 3 complete image memory. The edge enhancement stage increases the contrast of the object edges. The processed image data of the current FL image is stored in the intermediate memories MEM4 and MEM5. In this process, the vertical frequency of 50 Hz (write) is translated to 100 Hz (read) or of 60 Hz to 120 Hz. MEM 6 and MEM7 convert the stored image for monitor 2. The digital image data is converted back into analog output signals with the D/A converters.



Analog Input

The BAS signal of 1Vpp generated in the TV system terminates at the analog input amplifier at 75 ohms. In this input amplifier, the synchronous signal portion is isolated from the BAS signal and forwarded to the PLL for memory synchronization. In addition, the B signal is adapted here to the input range of the A/D converter. The blanking and synchronous portions of the BAS signal are cut off so that only the B signal portion is digitally converted.

PLL

The PLL (Phase locked loop) synchronizes the internal frequency generator with the synchronous signal isolated from the BAS signal. From this it generates the frequency and synchronous signals for the memory.

A/D converter

The A/D converter converts the analog B signal into an 8 bit value. This process produces 256 gray levels.

Control logic1

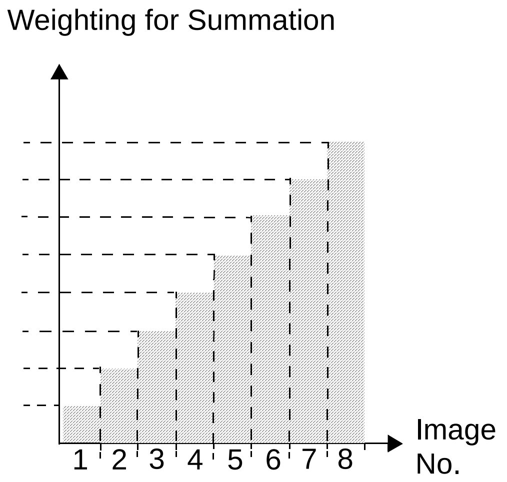
The image data is sent via these logic components and stored in MEM1, MEM2 or MEM3 according to the selection (FL, LIH, or stored image).

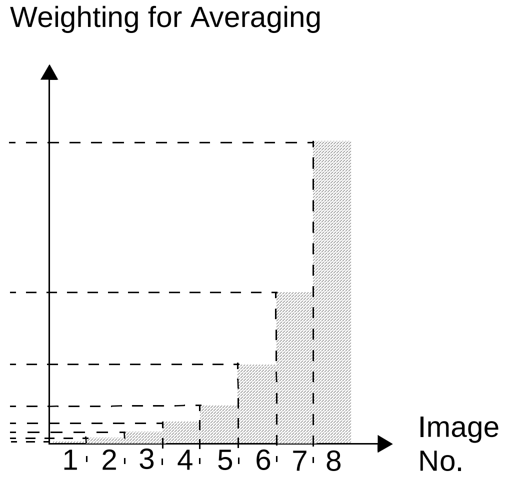
ALU (Noise reduction)

The ALU (arithmetic logic unit) is a computer component for calculating image data for sliding weighted averaging, summation, and motion detection.

Sliding weighted averaging and summation are image integration types that assist in noise reduction. The image information of the output image is produced from several images. The number of images to be integrated can be selected on the control panel. Integration factors are: 1 (no integration), 2, 4, 8, and 16. If a larger integration factor is selected, no movement of the object being examined may occur, since otherwise the image would be blurred by the timed integration.

Sliding weighted averaging is used for standard fluoroscopy while summation is used in DR mode. The difference between both integration types is that for sliding weighted averaging, the information content is taken from the individual images, while for summation the weighting remains the same.





ALU (Motion detector)

Since image quality problems (blurred images) occur during integration of moving objects, the motion detection function can be selected on the control console. In this process, the pixel values of the existing image are subtracted from the pixel values of the new image. If this produces a differential value that is above a programmed threshold value, the noise reduction factor is decreased. The motion detection function is available for fluoroscopy only. Two motion detection factors can be selected for SIREMOBIL Compact.

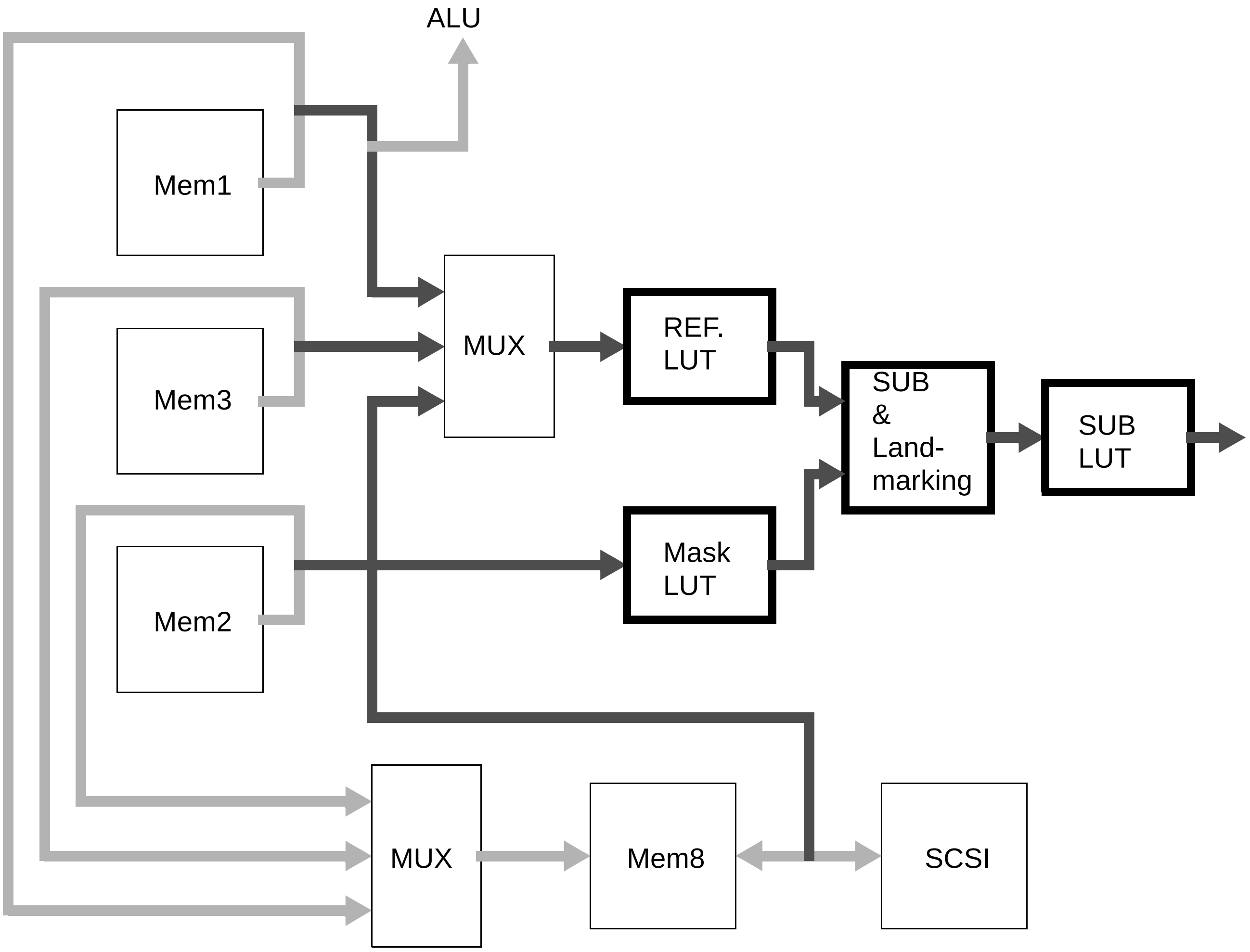
Memory 1

Memory1 is the working memory for the ALU. This memory has a matrix size of 512*512*12.

Memory 2 / 3

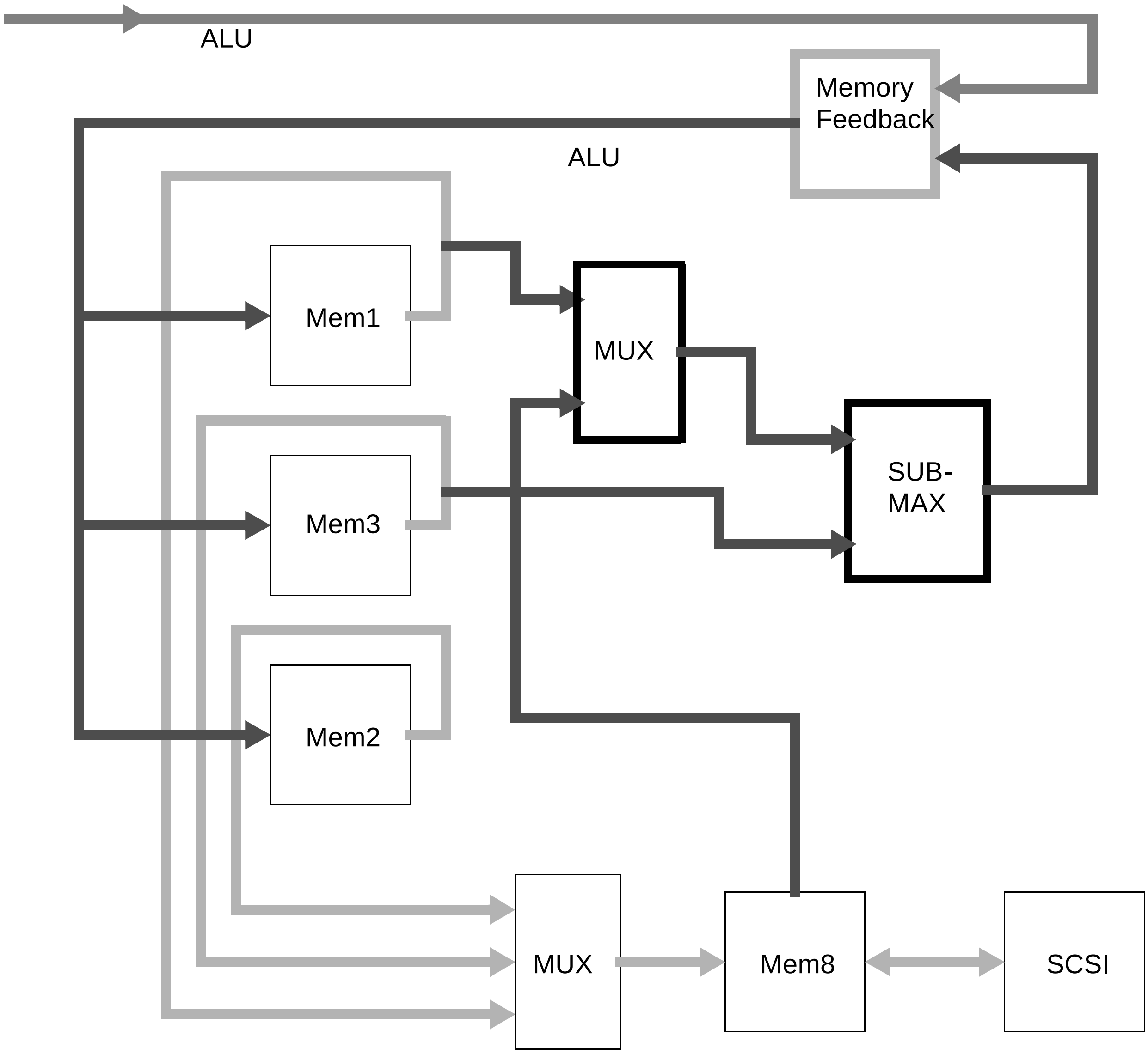
The memory images for monitor 2 are stored in memory 2 and 3. The memory matrix is 512*512*8. Two images can be displayed on one monitor (horizontal or vertical) via a split function.

Subtraction



With MEMOSKOP SUB, the "mask" (native image) and the fill (with contrast agent) images are stored in Memory 1 or Memory 3. These images are subtracted after adjusting them using LUT’s so that the resulting image contains only the differences between both complete images. The mask and fill images differ with respect to the flow of the contrast agent. This flow is displayed in the resulting image. To change the contrast of the subtraction image, a window can be opened via the SUB-LUT. The pixel values located within the window are adjusted at the D/A converter input.

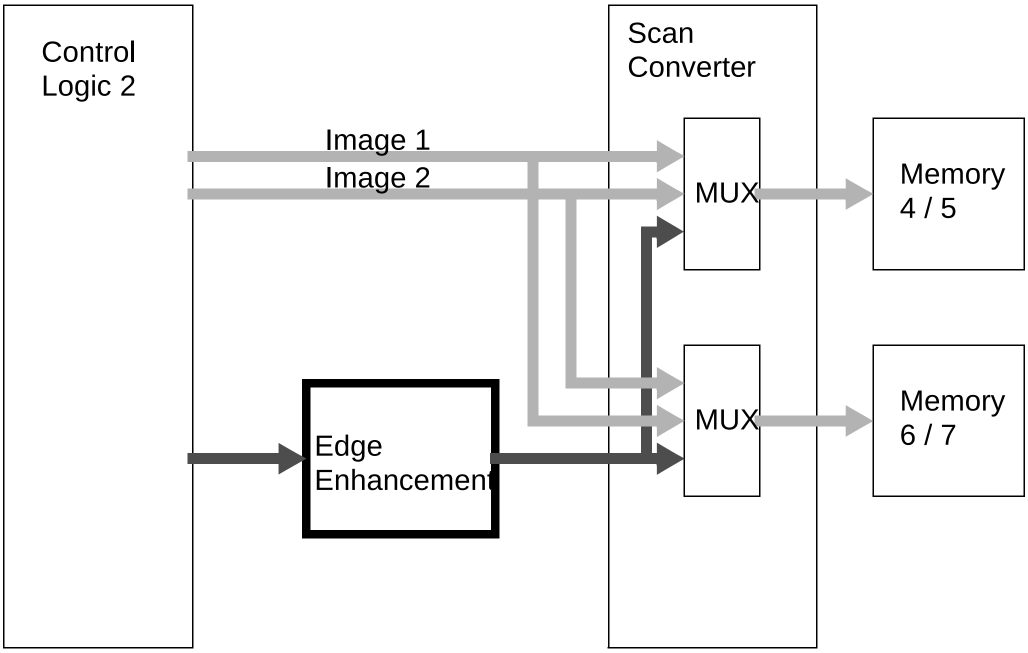
SUB-MAX function (maximum opacification)



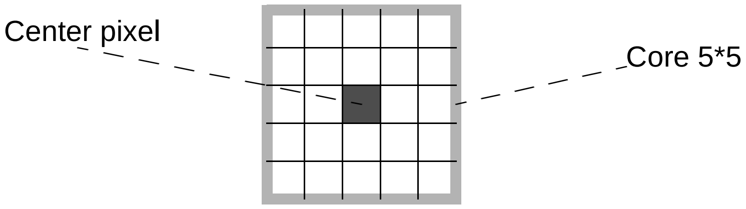
The **SUB-MAX** function is used to display the complete flow of contrast agent for a subtraction scene. To do this, the lowest pixel value is stored. If, for example, the value of a particular pixel in the new image is lower than in the stored image, the stored value is replaced by the new lower value. If the pixel value in the new image is higher, the lower value of the old stored image remains unchanged. Evaluating all complete images of a subtraction scene using this method produces a stored image which contains the lowest pixel values from all the complete images. This technique is used to display the entire contrast agent flow in the last image.

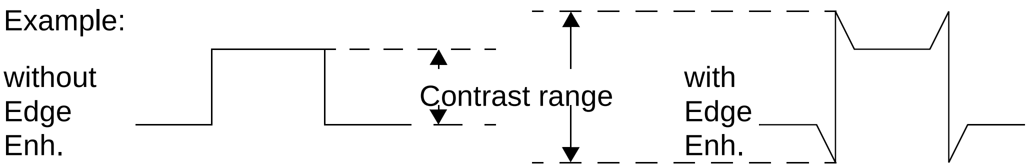
Images from Memory 1, Memory 3 and Memory 8 (hard disk) can be processed with the SUB-MAX function.

Edge Enhancement



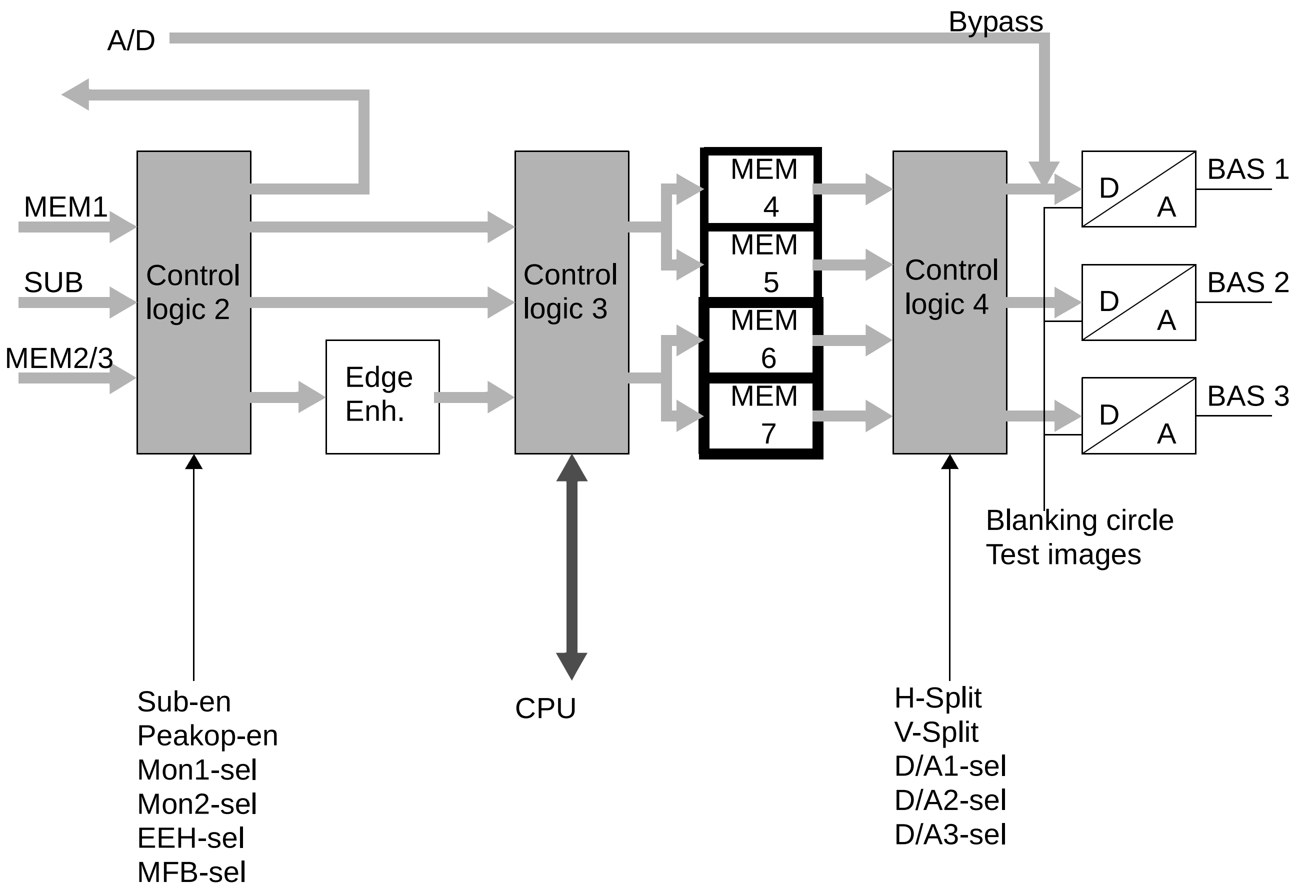
In order to increase the contrast, the pixel values can be modified at the image edges via digital spatial frequency filtration. To calculate the new pixel values, the surrounding pixel values are integrated. For MEMOSKOP, a core with a matrix of 5*5 is used.





MEM2/3

The images for monitor 2 are stored in memory 2 and 3. The memory matrix is 512*512*8. Two stored images can be displayed on one monitor (horizontal or vertical) via a split function.



Control logic 2

The image data is forwarded via control logic 2 either directly or via the filter to edge enhancement.

Control logic 3

The image data is forwarded to the display memory via this logic component.

MEM4, MEM5, MEM6, MEM7

MEM4 to MEM7 are memories which contain a half frame each. The complete stored image for monitor 1 is located in MEM4 and MEM5, and for monitor 2, in MEM6 and MEM7. The memories are subdivided into two areas. In this way, the image data for a half frame is written into the half of the memory at 50 Hz or 60 Hz V-clock frequency while the second half of the memory is read out at double V-clock frequency. In addition, the image data of the second half frame is written into the second memory half at standard V-clock frequency while the first half of the memory is read out at double V-clock frequency. The same process applies for MEM6 and MEM7.

Control logic 4

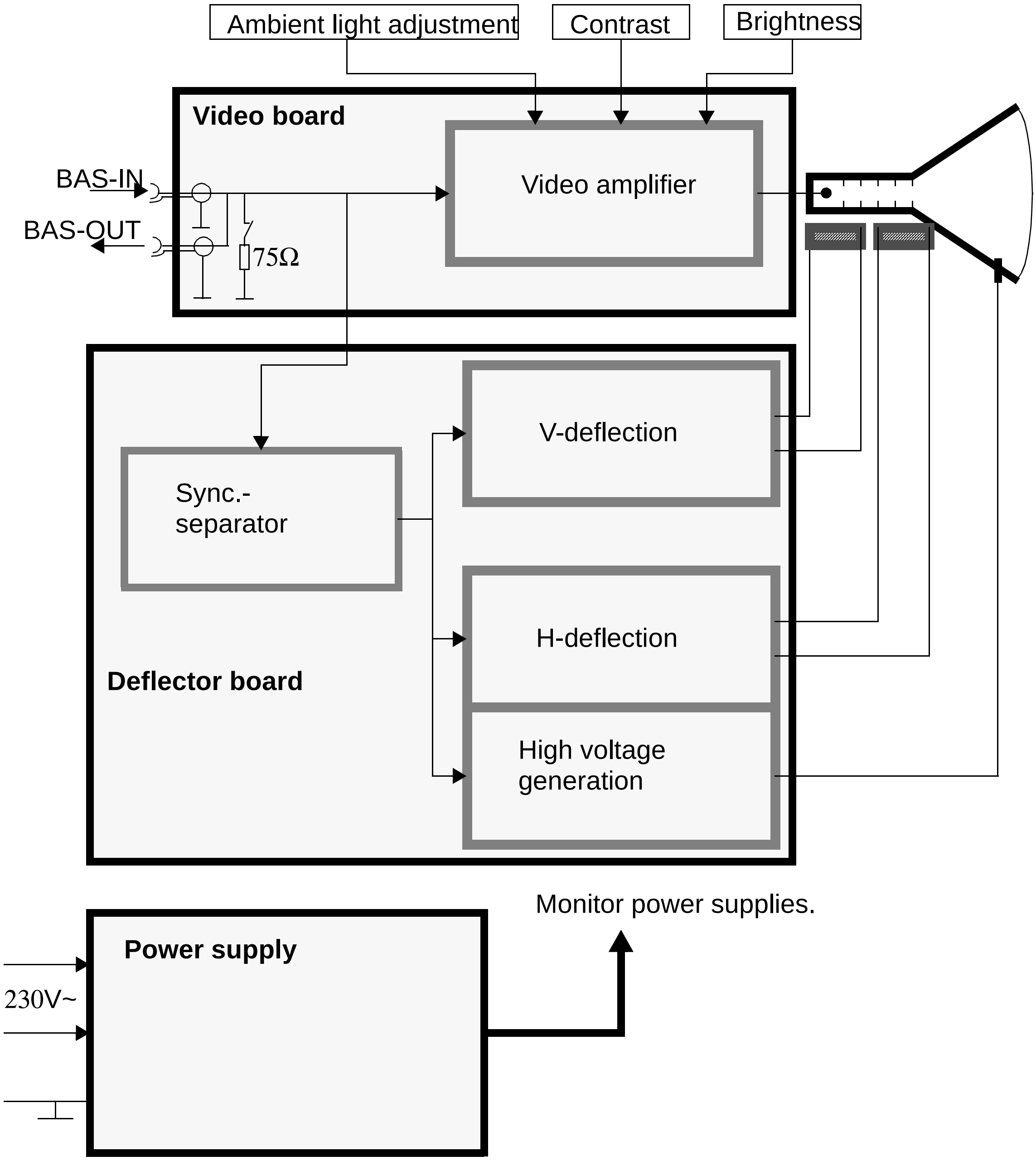
This logic component forwards the image data to the D/A converters.

D/A converters

The three D/A converters convert the digital image information back into an analog image signal. In addition, the blanking and synchronous signals are mixed via special inputs. A circular blanking signal is generated for this purpose in the MEMOSKOP. The text data is integrated into the image signal in this phase as well.

SIMOMED 90 N

Overview



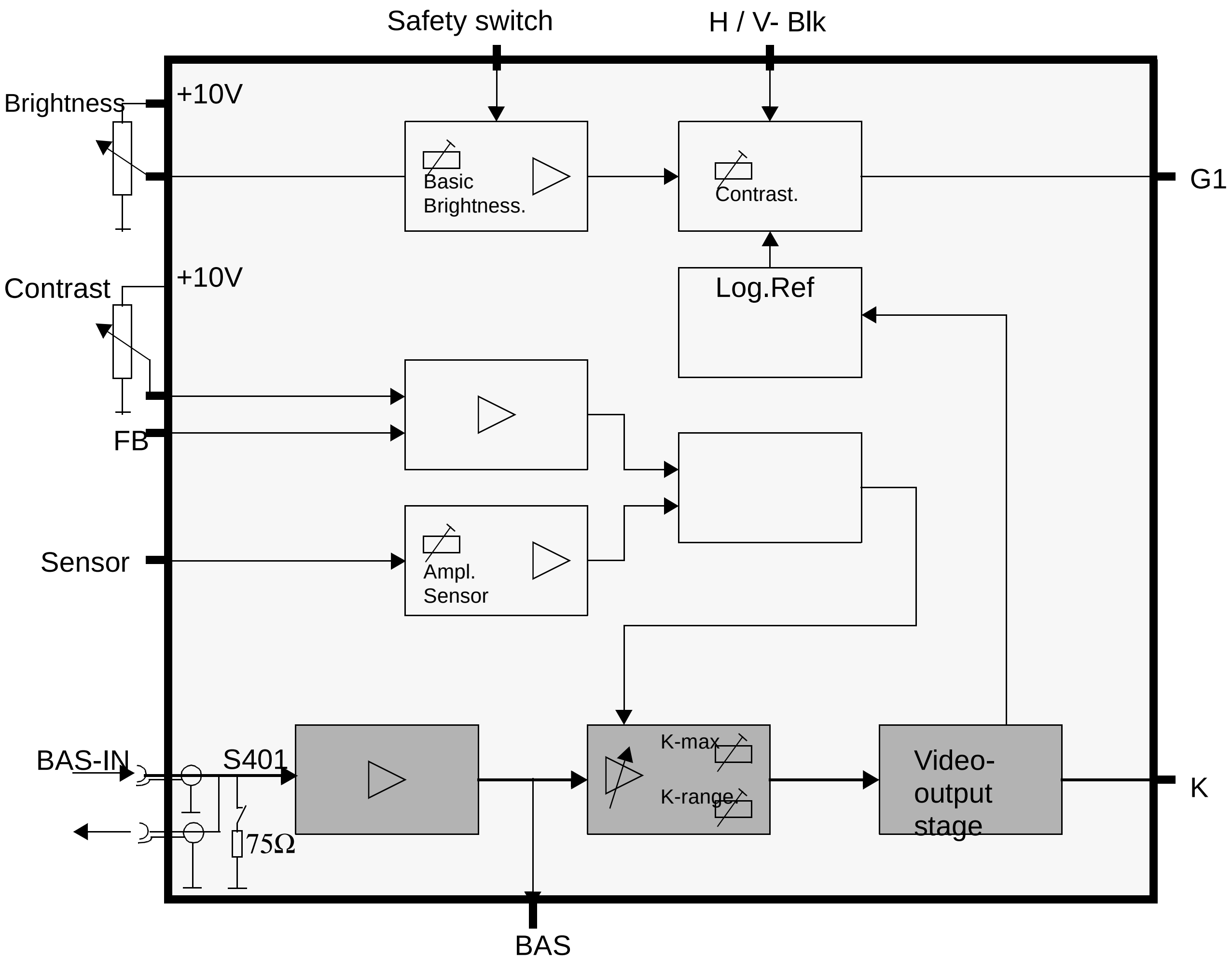
Three main boards are located in the SIMOMED monitor: the video amplifier board, the deflector board and the power supply board. Monitor service is done on the board level.

The power supply voltages for the monitor are generated on the power supply board.

All components necessary for the horizontal and vertical deflection of the electron beam in the picture tube are located on the deflector board. In addition, this board generates the high voltage for the picture tube.

The video amplifier amplifies the BAS signal that is supplied by the image memory at an amplitude of 1Vpp.

Video board

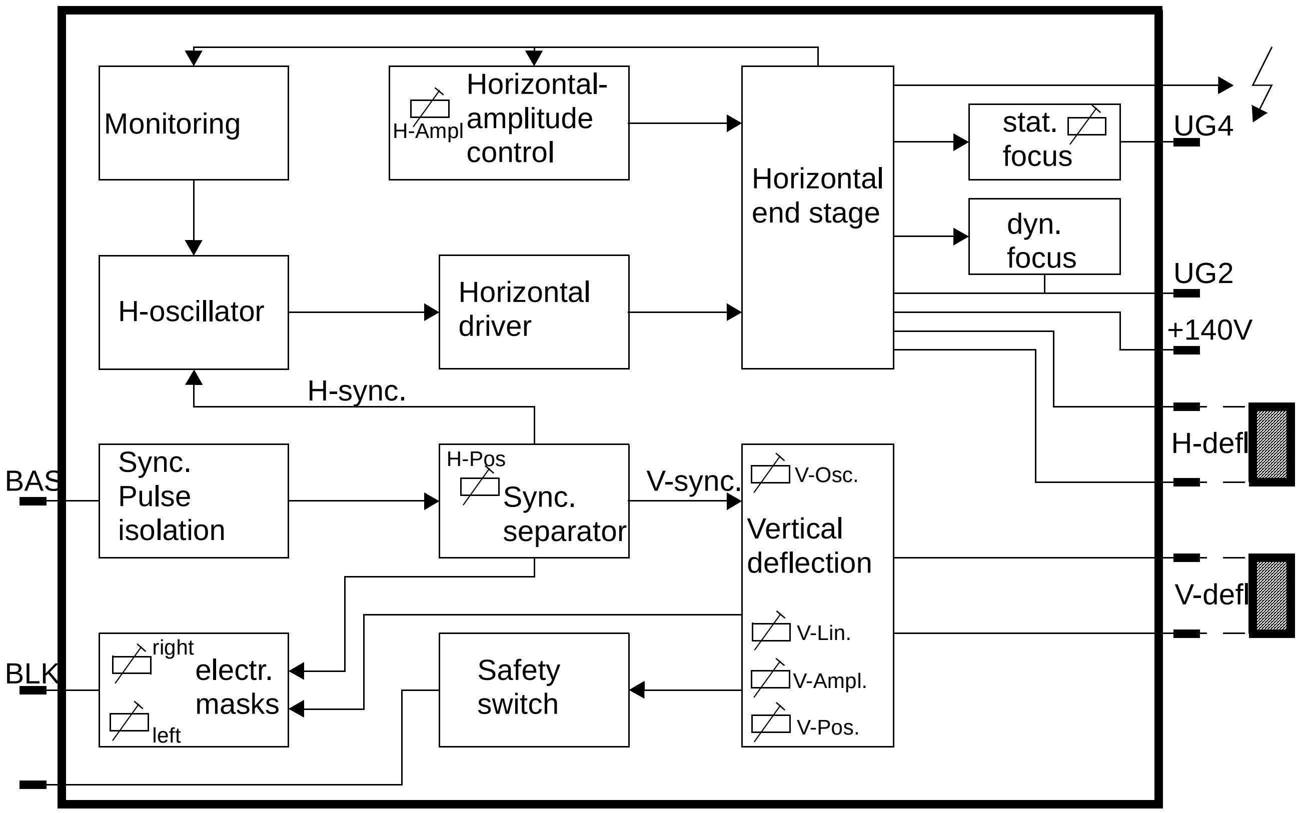


The following functions are realized on the video board:

- Video signal amplification at the required cathode level for the picture tube
- Contrast regulation
- Brightness regulation
- Blanking value clamping (with / without)

The BAS signal from the image memory is sent via the BAS input jack to the video board and terminates here with a 75 ohm terminator. If the BAS signal is being forwarded, it can be looped via the BAS output jack. If this is the case, the termination must be switched off with S401. The video signal is amplified to cathode potential with the amplification stages. The amplification factor can be changed with the contrast adjustment and the ambient light adjustment sensor. In addition, the brightness adjustment located on the video board regulates the grid 1 voltage and in addition, the brightness of the picture tube. The BAS signal arrives at the cathode of the picture tube AC or DC-coupled via a video power amplifier (with or without blanking value clamping).

Deflector board



The deflector board has the following functions:

- Vertical and horizontal deflection of the electron beam in the picture tube
- Generation of high voltage for the picture tube
- Generation of the grid 2 and grid 4 voltage (focussing)
- Safety switch to protect the picture tube from burn-in if deflection malfunctions
- Generation of an electrical mask for blanking the image signal on the edge

Synchronous pulse isolation

The horizontal and vertical synchronous pulses from the BAS signal are isolated with a limiting circuit. In addition, the H and V synchronous pulses are separated from each other to control the H or V oscillator. If the synchronization signals fail, the oscillators continue to run so that the blanking does not fail leading to screen burn-in of the phosphor layer of the picture tube.

Vertical deflection

The vertical oscillator generates a frequency that corresponds to the V synchronization, and which is forwarded to the next integrator. This integrator generates a vertical frequency, saw-toothed current, that is conducted via a power amplifier of the vertical coil of the deflection unit. The magnetic field of the V deflection coil deflects the electron beam in the picture tube in the vertical direction.

H-Oscillator

The H oscillator generates a horizontal frequency to drive the horizontal power amplifier. The H oscillator is synchronized with the H synchronous pulse.

Horizontal power amplifier

In the H power amplifier, an H frequency saw-tooth current is generated for the H-deflection coil of the deflection unit. This generates the magnetic field required to deflect the electron beam in the horizontal direction. In addition, the high voltage for the picture tube is generated in the H power amplifier, by transforming the line flyback pulse which is generated. In addition, the voltages for the grid 2 and 4 of the picture tube (focussing the electron beam) are generated here. The picture width is controlled via the H-amplitude control.

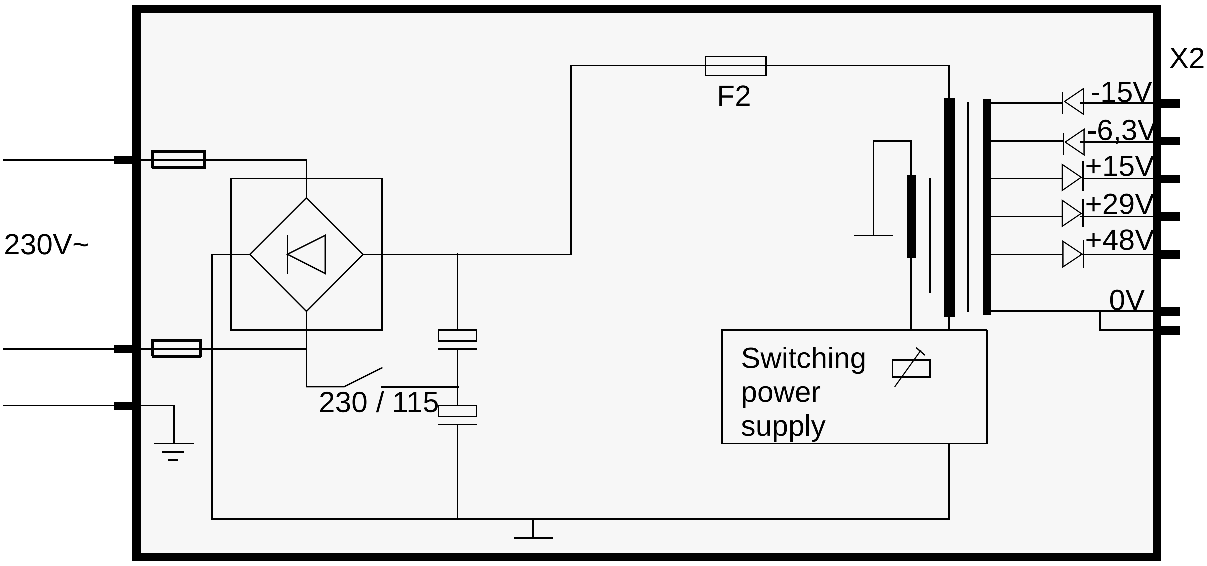
High voltage monitoring

For monitoring purposes, the high voltage actual value is reduced via a voltage divider and compared to a minimum value in the monitor. If this value is not attained, the H-control is blocked. To restart it, the system must be switched off and back on again.

Electronic masks

For blanking purposes, masks can be individually set up on the right or left of the monitor.

Power supply board



The power supply voltages for the monitor are generated on the power supply board with a primary controlled switching power supply. The switching frequency of the power supply is 25KHz. Supply voltages of +/-15V; +29V; +48V and 6.3V(to heat the picture tube) are generated.